THE EXPERT WOOD FINISHER

A. ASHMUN KELLY

THE EXPERT WOOD FINISHER

A HAND BOOK FOR EXPERT WORKMEN AND LEARNERS IN THE ART AND PRACTISE OF FINISHING WOODS BY STAINING, FILLING, VARNISHING, RUBBING, POLISHING, OILING, WAXING, ETC.

With a Glossary and Table of Contents for Easy Reference.

BY

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PREFACE TO THE SECOND EDITION

In a little over two years the *Expert Wood Finisher* has run through its first edition, which was made large in anticipation of a large demand. Usually, technical books have a rather slow and limited sale, this being particularly true of works issued in the interests of painters, etc., but the *Expert Wood Finisher* has proved a notable exception to the rule. While the fact of its large and ready sale has primarily been due to its practical character, yet the author would feel derelict if he failed to mention the many very flattering press notices that the book elicited. Such notices did much to bring the book into more general notice, and to assist in its sale. Then there were the many book catalogs which listed it, due to which were many sales. Pratt Institute listed it in their catalog under the head of "books worth while," and the Director of the Library connected with that noble institution for helping men spoke very favorably of it. Sales were also made through the agency of many book concerns throughout the United States and Canada, A. C. McClurg & Co., Chicago, and Taylor & Baker Co., of New York, keeping it in stock. Henry Bosch Co., Chicago and New York, buy it in quantities and are among its heaviest sellers, mainly among painters. The book is also advertised in the trade journals going to publishers and book sellers, and many public libraries of the country, from coast to coast, and including Canada, have bought it. Several trades journals also have sold many copies of the book.

And now a second edition is called for. This will be a new edition, not simply a re-print. The entire book

has been re-written, or re-arranged, and many valuable additions have been made to it, with the elimination of some matter, deemed necessary in order to put the work right up to date. In its new form the book is even more useful than the first edition. Those who have the first edition will find it worth while to buy the second.

A. Ashmun Kelly.

THE EXPERT WOOD FINISHER

CHAPTER I

DESCRIPTION OF WOODS USED IN WOOD FINISHING

OAK.—Only the use of their scientific names can prevent confusion when speaking of the oaks. Foresters divide all the various oaks into two distinct groups, namely, the white and the black. The woods of the two groups are structurally different. The true white oak, *Quercus alba,* is merely one of the species which make up the white oak group. Red oak has a number of other common names, such as mountain oak, black oak, and Spanish oak, yet it is a member of the black oak group. Red oak is more abundant than white oak, grows faster, and is generally regarded as inferior; the two species often grow together and occupy the same general region. When white oak was abundant it was derived almost entirely from the true white oak, the *Quercus alba,* but now what passes for white oak is usually a mixture of different oaks, in which there may be no true white oak at all. The true white oak combines approximately the utmost strength and toughness of any of the timber oaks, excepting possibly the Southern live oak, prized for ship building. At one time white oak forests extended from the Atlantic seaboard to about Missouri, and seemed in inexhaustible supply.

Of the white oak group those most used, in addition to the true white oak, are burr oak, chestnut oak, post oak, chinquapin oak, swamp white oak, cow oak, and overcup oak. Of the black oak group the most used are, Texas red oak, red oak, and spotted or water oak. Real white oak of No. 1 quality is very largely cut into quarter-sawed boards, while a combination of one or more white oaks and red oak may constitute cuts of "white oak." In many markets the term "cabinet white oak" is understood to include a mixture of red and white oaks, but not infrequently it means simply red oak. However, for all the purposes for which white oak is commonly used, practically all the trees of this group will yield woods that can be interchanged and will serve equally well.

Live oak is not used in wood finishing, yet it is well adapted for that purpose, being very hard and compact, close of grain, taking a high polish, and growing darker and handsomer with time. But the woodworker will find it very difficult to work. It seems never to have been sawed into quarters, though owing to its known grain it is sure that no figure would result from quarter-sawing. Nor is it ever made up into boards, its sole use being for ships. Its botanical name is *Quercus virens,* so named because it retains its green leaves until the new foliage of the next season appears. Its habitat is the Atlantic and Gulf coasts, from Norfolk to Texas.

What is known as quartered oak is said to have originated in Indiana, about 1871 or 1872, but the beautiful markings shown have been familiar for many years, and always admired. Probably they have been known in our country since the time of the earliest settlers who, in cutting oaks for fences and clapboards and other building lumber, split the wood in such a manner as to reveal these beautiful flakes and hearts to the best advantage; many old-time houses still show, in their well-worn stairs, the quartered effect. In modern practice the oak

log is first sawed through, in regular order, when it is desired to get simply the straight grain effect; and to get the quartered effect the log is sawn so as to produce four quarters, these in turn being sawed at right angles with their V shape; this process involves great loss of wood which, however, can still be utilized in other ways.

Mahogany.— While many woods are known as mahogany, yet but one is justly entitled to the name, that one being the wood of the species called *Swietenia Mahogani,* order of *Meliaceae.* Probably no other order of trees yields such a variety of valuable wood, and of which the true mahogany is the most important. The term white mahogany is sometimes heard, but such is not a true mahogany, for the color of true mahogany, red, is a distinguishing feature of that wood. It is, rather, a rich red-brown, a color that may be made by mixing together eighty-five parts of black with fifteen parts of yellow or orange chrome. Or by this formula: Black, eighty-three parts; red, four parts; and orange yellow, thirteen parts. This reddish-brown color of true mahogany is not dull, but lustrous, in some instances reaching the degree known as "fire." Cape mahogany shows much of this fire or phosphorescent luster.

Baywood is a name used to describe mahogany, some believing it is simply a substitute for true mahogany, whereas, it is a name once given to true mahogany because of the place of its growth, the Bay Islands, of Honduras. Even now true mahogany wood is spoken of as baywood. The mahogany from Central America used to be called baywood, whilst that from the West Indies was called Spanish mahogany. It is likely that much of the mahogany used now is really Spanish cedar. It is stated by an authority that fifty different woods are sold under the name of mahogany; twenty-five under the name of cedar; and more than a dozen each under the names of rosewood, satinwood and boxwood.

Touching the physical characteristics of mahogany, it is cold to the touch, it is a heavy wood, being very hard and close grained; it is durable, and seldom warps, cracks, or shrinks under trying conditions, if well seasoned. It stands all climates and is very lasting under water, if kept constantly wet. It is mostly all heartwood, with usually only a thin rind of sap wood. The cabinet maker finds it a very difficult wood to work, owing to its irregular grain, and this feature of the wood proves troublesome to the wood finisher as well. True baywood, the name given to a wood resembling true mahogany, as well as to the real mahogany itself, is a scarce wood now, but was a very poor substitute for mahogany, because it was very soft and light and possessed none of the fine markings that mahogany has, its grain being straight. Yet as it had some of the color of mahogany and took stain well, it was useful for making a substitute mahogany.

Circassian mahogany comes from the tree *Juglans Regia,* which grows on the southern side of the Caucasus mountains. The wood is of rare beauty both in color, figure, and contrasting veins in the dark tones with the delicate ivory surface of the body. These contrasting shades and figures are found in infinite variety. The beauty of this wood is doubtless the effect of certain peculiarities or defects of growth, the most beautiful wood being the most defective. Circassian mahogany wood is used mostly for veneers. But owing to the scarcity of this wood, particularly the choice burl parts, the veneers are usually made extremely thin, and when this occurs the finish is sure to be unsatisfactory, hence many people are prejudiced against it. It is particularly handsome for picture frames.

Maple.— This is one of our finest and most useful hard woods. The ancient Romans highly prized it for making pieces of furniture; Pliny tells us that it could be

had only in small pieces, that it was used for making writing desks, etc. The maple is of the genus *Acer*, all its species being confined to the north temperate zone, these species being eighty in number, only nine or ten being native in the United States. The woods of interest to the wood worker and finisher are the hard or rock maple, or sugar maple, the white or silver maple, and the birdseye maple, sometimes called the curly maple. There is an Oregon maple of great beauty when finished, it being light in color, with a surface covered with small waving lines, these showing beautifully at any time, but particularly in the glow of artificial light. Ordinary hard maple has little particular beauty as regards figure, but its color and fine hard grain make a very fine finish, and the wood is very useful in furniture making and for floors. The curly or birdseye maple is used solid and also in veneers. Its grain varies as the saw divides its eyes transversely or longitudinally, and pieces cut out in circular sweeps, such as chair backs, sometimes exhibit both the birdseye and the mottle at different parts. The occurrence of eyes, zones, spots, and small curls in this wood form figures of much beauty. The wood shows, in the finished work, the peculiar appearance of small dots or ridges, or of little conical projections, with a small hollow in the center, but without any resemblance of knots, the apparent cause of ornament in other woods of similar character, as the burrs of the yew and Russian maple, or birch. Formerly it was thought that these so-called eyes were the result of birds pecking at the bark, but Holtzappfel investigated the matter carefully and found that they were caused by little spines or points in the bark, the layers of wood being molded upon these points, and each of their fibers is abruptly curved at the respective places, and when cut through they give, in tangential slices, the appearance of projections, the same as some rose-engine patterns.

The white or silver maple also gives a very fine finish at the hands of the expert wood finisher. It is specially useful for stiles and rails of doors, surrounding birdseye panels, etc.

Red Gum.— This wood is sometimes called "satin walnut," a lumber trade name, but it possesses beauty enough to entitle it to its true name. The tree is a very common one in the Southern States, growing to magnificent proportions in the best soils. Its heart shows a wide range of both color and figure; it is slightly darker than newly cut mahogany, and some parts of it are more elaborately figured than that wood. The color in general resembles that of mahogany. It is liable to warp and twist, but careful seasoning tends to reduce this to the minimum. Many costly buildings in the east and west are finished in this wood, and much is also used in furniture making. Finished natural, the wood yields a very pleasing effect, filler and varnish bringing out its handsome figure and color; or it may be stained variously. For the floor it looks best done natural. Being a very tough and good wearing wood it is well adapted for floors. If used for exterior siding it should be primed before being put up. It contains no acid sap, hence takes paint very well, and will not rust out nails. While its figure resembles mahogany somewhat, yet its color is more like that of cherry; the grain of the wood is close, and it takes a very fine polish. Its red color takes on a purple cast, very rich and soft.

Birch.— This wood is close-grained, and is capable of taking a high polish. There are the sweet or black birch, the yellow or gray birch, the red birch, and the white or paper birch. The wood comes both straight and curly, the grain is fine and its texture close. Generally its grain runs straight, and while it is a heavy, hard wood, it is never tough or cross-grained. It is easily cleaned up and made ready for finishing. It is usually stained, but

mahogany color does not look well on it; white birch usually is finished natural; a dull finish is best for any birch.

The sapwood of yellow birch is yellowish, the heartwood light to dark reddish brown. It is the heartwood of birch that furnishes the beautiful red birch, which has no superior even in mahogany. Both sapwood and heartwood take a brilliant, satiny polish. The figure of curly birch is especially attractive, while the sparkling luster of the finished wood gives a richness of tone such as is usually looked for only in the costliest imported woods.

Fine as this wood is it has its disadvantages too. First, it is difficult to finish natural, on account of its lack of uniformity of color and marking; stained birch is apt to fade. On its behalf it may be said that it has the highest physics, or quality, of any American hardwood growing in reasonably large quantity, excepting that of the best types of oak. It has a strength and density far superior to gum, will hold its finish better, and when stained with any other than aniline stain will hold color as well as any wood. Briefly summed up, birch has density, weight, strength, good working qualities, and moderate cost. The woodworker will likely find fault with birch on account of the oil it contains, and which he says prevents proper gluing of joints. Excepting in the best grades of furniture he does not try to match the wood's figure very closely, so that in a glued-up job he can put the sap edges together and the heart edges together, which will insure a good glued joint. Then the finisher can stain the light parts to match the dark, and follow with a light coat of stain to make all harmonize. Or he may stain the filler too.

Beech.— The red variety of this wood is very handsome, and makes a very good imitation of cherry when stained. It has a fine grain and is a very durable wood. When quarter-sawed its beauty is further enhanced.

Like birch, it came into general use when other used hardwoods became scarce and dear. It has for years been used for making tool handles, etc.

Redwood.— This wood grows only in California, and there only in very restricted parts, the home of the famous big trees, of which there are two species, *Sequoia Gigantica* or big tree, and *Semper Virens,* or ever-living tree. We get our redwood from the latter tree, the wood from the former being valueless for building purposes. Redwood is very durable, but is a rather difficult wood to paint on, though it is not difficult to finish with stain and varnish. It contains a sap of a gummy nature, and this prevents the proper drying of paint or oil upon its surface. Hence oil stain is not the best for it. Yet it contains no pitch. It has a hard heart-growth, non-absorbent, with a soft body outside of that. It has a good color, so may be finished natural, making a very handsome finish too.

Cypress.— This is a Southern tree, the *Taxodium Distichum* of the scientist, its leaves, being narrow, placing it among the soft woods. Locally it is variously known as bald, black, white, red and deciduous cypress. It is not as abundant as the pines, and in its uses and appearance it is not unlike white cedar; a very durable wood. It has good color, is free from sap, has a straight grain, and is light and strong, and is extensively used in house trim. Exposed to the weather unpainted the wood becomes dark and unsightly, but when used inside, although it darkens in time, yet the darkening is rich, not unsightly. One of its objections is to quickly rise its grain under the influence of any dampness, making the surface rough; hence it should be finished as soon as possible after being put in place.

Hard or Yellow Pine.— The pine is a member of a large family of useful trees, *Coniferæ.* It is not difficult to tell a pine from a spruce, or fir, larch, cedar, etc., of the

same family, and formerly included in the same genus, *Pinus*. The pine is easily distinguished by its evergreen, needle-like and short or long leaves, and its cones. Of the some seventy-six species known twenty-six are found in the United States, among which the most common are the white pine, now nearing extinction in our forests, the long-leaf, Southern yellow, or Georgia pine, the loblolly, the red pine. Then there is the Douglas pine of the Pacific coast, sometimes called the Oregon pine and Douglas spruce, a tree that grows to an immense height, as much as 300 feet in some cases, with a diameter of eight to fifteen feet. The long-leaved pine, called also Georgia pine, hard pine, yellow pine, and red pine, is one of the most important of the family in our country, for it gives a good building lumber and furnishes the rosin, turpentine, etc., of commerce, and as fuel makes a very hot flame; it is often used also for railroad ties, though not so desirable for this purpose. It is a very hard, strong, compact yellow or reddish wood, and is highly resinous. There is also the heavy-wooded pine of the Rocky Mountain regions, the wood being strong, coarse-grained, yellowish, and heavy, and is used mostly for floor joists, flooring, and heavy carpenter work generally.

The long-leaved pine is called for distinction the Southern yellow pine. The name yellow pine is applicable to any of various species of *Pinus*, but especially of the common yellow pine found east of the Rocky Mountains, and which is also known as spruce, bull pine, and, in contrast with the Southern yellow pine, short-leaved pine. White pine is a term applied to any one of several species of *Pinus* having a white or whitish wood, and their leaves in clusters of five. The once common white pine (*P. Strobus*) of the northern United States and Canada has been the most valuable tree for building purposes in this country. There are still some kinds of

white pine that serve to take its place, but in color, texture or grain it is not equal to the old white pine. But there is a vast quantity of it, however.

The Georgia pine has straight grain, while the North Carolina pine has a very beautiful variegated mottle.

Sycamore.— This is the American plane tree, but more commonly known as the sycamore, or buttonball. It is one of several trees constituting the genus *Platanus*. The tree differs so much in appearance from any other tree that it is one of the most easily recognized. Its wood is very dense, its markings beautiful, and it is further improved in this latter respect by quarter-sawing. It takes a handsome finish. Oregon sycamore resembles the birch of the Eastern states in its markings, having waving lines that run close together. It is a tough and strong wood, and well adapted for making veneers.

Ash.— There are several varieties of the ash, but the ash tree furnishing the most valuable timber of any is the white ash (*Fraxinus Americana*) of the United States and Canada, a large forest tree, having a light, tough, elastic, hard, close-grained wood, and which is specially adapted for making agricultural implements, wagons, etc., no other wood serving as well the purposes mentioned.

The ash of the Eastern states has a close, even grain, while that of Oregon has peculiar figurings of concentric curves, taking a very fine polish. Ash is used now in connection with common oak, passing as oak when stained and finished as such. Although the grain of the two woods is entirely different, yet with filling and staining ash looks very like oak; often it is used for cheap furniture, selling under the name of oak, or used with oak in the same piece of furniture, to save the costlier oak in certain parts of the work. Hungarian ash has a beautiful burl, making fine panels and veneers. The English white ash is similar to the American and Canada white ash.

Walnut.— The walnut is a tree of the genus *Juglans,* the two members of this family of most importance being the Persian or so-called English walnut, *J. Regia,* whose wood is excellent for cabinet work, and the black or American walnut, *J. Nigra,* a darker colored wood than that of the English walnut and of greater value for cabinet work. Black walnut once grew in vast areas in our country, especially in the Middle West, the State of Indiana most particularly, where it covered nearly the entire state. Now probably very few specimens of this noble and useful tree exist there, and few specimens may be found anywhere in our domains. Less than fifty years ago the finest furniture was that made from black walnut, and to-day it is used in preference to any other wood for making gunstocks. The tree grows well in any part of the eastern half of our country, but does best in a moist, rich soil, grows fast, and is easily raised from the seed. The figure of the wood varies according to the manner or location of its growth, that growing in forests having a straight grain, while single specimens, growing in the open, usually have more or less figuring and better or deeper color. The wood is easily worked and is susceptible to a fine finish. French walnut comes in the burl variety, and is used for veneers.

Rosewood.— A fragrant cabinet wood having a close grain, which is more or less variegated, and very hard and dark. It is a Brazilian tree, of the genus *Dalbergia,* the wood which we meet with being from the *D. Nigra,* the most highly prized of the many members of the genus. It gets its name from the fact that when fresh the wood is rose-scented. There are inferior grades of this family of trees, of other species, known as violet wood, kingwood, etc.

Cherry.— This is one of the most valuable of all our native woods, bearing a valuable fruit, yielding a fine wood for cabinet work, and its wood giving a good flame,

when used as cordwood. It belongs to the genus *Prunus*, the two most useful cabinet woods being the wild black and cultivated cherry. It is what wood finishers term a close-grained wood. Usually it is stained to imitate mahogany, yet its natural color is good, and will give a fine effect when finished natural. As an imitation of mahogany, however, it is equaled by no other wood.

Chestnut.— A tall, familiar tree of the oak family, *Castanea vesca,* found growing in poor, stony soils in the eastern part of the United States, and not doing well in rich soils. The recent appearance of a disease among these trees in certain parts of the Middle and New England states at first threatened to destroy the species entirely, but at this writing the situation appears more favorable, with the disease under control. The wood is coarse of grain and very open of pore, so that it requires to be filled with paste filler in its finishing, as will be described fully in another place. The wood is used largely in house building, and carefully selected parts skillfully put together make very handsome doors, panels, etc. Cheap furniture is made from this wood, and usually is stained to imitate oak. It possesses many good physical features, being easy to work, not inclined to warp or twist, not affected by dampness, but its coarse grain and very coarse heart growths make it less desirable for cabinet work or house trim.

Butternut.— This wood is little used by the wood finisher, and little need be said concerning it. It is the North American white walnut, *Juglans Cinerea.*

CHAPTER II

HOW TO FINISH HARD AND SOFT WOODS

THE wood-finisher has to take the wood as it comes from the wood-worker's hands, and if the latter has done his part well, then the finisher may proceed at once to fill, stain and varnish the wood as may be required. Otherwise, if the wood is not in proper condition for finishing, the finisher must take it in hand and make it fit. The surface must be made smooth with sandpaper, and after being made free of dust, the stain or filler, according to kind of finish, may be applied. Different woods require different treatment, as some are close grained, others coarse grained, while a third class is midway between the two. Each wood will be taken up and the method of treatment for each described in order. Also, the various kinds of finish, whether with stain, wax, or varnish, will be described.

The woods classed as soft woods have a close grain, and such as wood-finishers have to finish are these:

Bass	Spruce
Cedar	Tamarack
California Redwood	White Pine
Gum	Washington Fir
Oregon Pine	Whitewood
Poplar	Yellow Pine

The following named woods are classed as open-grained or hardwoods.

Ash	Chestnut
Beech	Elm
Butternut	Mahogany
Baywood	Oak
Black Walnut	Rosewood

The woods that are placed in a third class, because they may be filled with paste or liquid filler, while the soft woods are filled only with liquid filler, and the hard woods with only paste filler, are these:

Birch	Circassian Walnut
Cherry	Maple

In workshop parlance all the woods are called hardwoods, hence hardwood finishing, but it will be seen that there are about as many soft as hard woods treated by the so-called hardwood finisher. Yellow or hard pine can with greater accuracy be called a hard wood, rather than a soft wood, yet it takes the same filler as white pine, or as poplar or whitewood, which are very soft woods. In fact, no hard and fast lines can be laid to classify the different woods as to physical characteristics, excepting that which places them all either as requiring liquid or paste filling. So that we need not concern ourselves about classifying them as being either hard or soft.

Filling the Open-Grained Woods.— These woods require a paste filler, because this filler contains enough solid pigment to fill up the open pores of the wood, with sufficient liquid to carry the filling into the wood and saturate its cellular tissue; the filler also contains a drying liquid in suitable quantity to hasten the drying and help the hardening of the filling. Some woods are so very open-grained that one coat of paste filler fails to fill properly, in which case two coats must be applied, or,

in some cases, a coat of liquid filler over the coat of paste filler. As stated, the purpose of the paste filler is to fill up the open parts, making a hard and level surface for the subsequent coats of varnish, while the purpose of the liquid is to fill up the tissue or woody structure so that when the varnish is applied it will not sink into the wood and hence fail to " stand out," thereby necessitating added coats of varnish, involving extra time and expense. In preparing his filler, therefore, the finisher mixes it according to the requirements of the wood in hand. He can either mix his own paste and thin it to suit, or buy the paste. I give formulas for mixing various fillers, both liquid and paste, which see.

In filling these woods we must take into consideration their natural color, also whether we wish to change this color by staining, or leave it " natural." Paste filler is light in color, something like the color of putty, and when filled into the wood it causes no particular discoloration, hence is used when the wood is light and it is desired to make a natural or light finish. But if we wish to produce a colored finish, then we must stain the wood and color the filler to match, making the filler rather darker, if anything, than the wood. The color should be as near the natural color of the wood as possible, only a trifle darker. This is important. There are many ways for finishing, or staining at least, in order to get different effects, all of which will be described in the proper place. Sometimes the filler will be colored, while the wood will remain natural, or unstained; this gives a unique effect. Some finishers give the wood a coat of raw linseed oil, adding driers enough to dry the oil, and when this coating is dry they apply the filler, whether it be paste or liquid. They claim that this prevents the raw wood from absorbing too much liquid from the filler, and no doubt this is true, and not objectionable in any way. As paste filler is rather thick, too

thick to spread with the brush, it must be thinned with turpentine until of the consistency of oil paint, and when ready to apply proceed as follows:

Filling with Paste Filler.— There is a brush sold that is made particularly for paste filler, but many finishers claim that nothing in the way of a filler brush excels a short, stubby, half-worn flat paint brush, or a round paint brush, according to area of surface to be coated; a wide brush for a large surface, and smaller brush for smaller surface. The brush should be neither too stubby, nor too long of bristle. The paste must be well rubbed into the wood, and a liberal coating of the filler must be applied. Put plenty on, then rub it in well, rubbing across the grain of the wood, as in this way the filler will the more readily lodge in the open pores. This rubbing in is done, not with a brush, but preferably with a wad of tow or a piece of coarse burlap, just as soon as the paste filler "sets," or becomes "dead flat," or without luster; this will occur in about twenty minutes after the application of the filler. If allowed to become too dry it will be difficult to rub off, while if rubbed too soon much of the filler will be removed from the wood's pores. This rubbing forces into the pores all the filler they can take, while removing the surplus from the surface to some extent, that remaining being sandpapered off after it has become dry. A coarse material like excelsior, as used by some, is not advised, as being so coarse as to pull out instead of pushing in the paste filling. Cotton waste is not a bad rubbing material.

The filled wood should stand at least twenty-four hours, and preferably forty-eight hours, before sandpapering and further treatment. The idea is to have the filling perfectly hard or dry before applying further coatings, as these latter would seal up the filler from the air, and by keeping it comparatively soft would cause trouble in the finish.

When perfectly dry, the work may be sandpapered smooth, and if the filling has been done properly the surface will be uniformly filled and solid. A magnifying glass of low power, such as one may buy for a trifle, is a useful help at this point of the work, as it will serve to indicate more clearly the exact condition of the filled surface. It would surprise you, too, for it would doubtless show you that what you accepted to be a perfectly filled surface was at least something less perfect than that; it might show you many little unfilled places. In such a case, and where it is desired to have an extra fine finish, it would be well to give it another filling. Varnish will not fill, at least not unless many coats are applied, each coat sandpapered or rubbed into the wood, which was the olden way. However, for ordinary work the usual good work in filling, one coat, will answer the purpose very well.

Carved parts may be filled by paste filler made thinner than that used on the main work, applying it with a painter's sash tool, No. 4, and wiping off lightly with a clean cotton rag. If the filler should "set" too quickly add a few drops of raw oil to it. When dry, make smooth with No. 0 or 00 sandpaper, then dust off and finish as desired. The surplus filler found in the corners, moldings, etc., may be removed with a tool of soft wood, whittled to a point; the handle of a tooth brush, one end filed to a point, the other end made chisel-shaped, is a very useful and durable tool for the purpose. Where carved work is done such a tool is indispensable.

How to Make the Filler.— There is no question among the best finishers as to the superiority of silica as the base for a paste filler. The silica must be the very finest, pulverized and "floated," and even in this condition of fineness when placed under a magnifying glass of a certain power it may be seen as a mass of sharp pointed needles, or crystals, and it is for this reason that it

makes such an excellent filler, the crystals filling and wedging fast in the pores of the wood, and being of an indestructible nature, unaffected by any ordinary agency that would injure any vegetable filler, like cornstarch, for instance, makes it doubly desirable. Yet many still use the cornstarch filler. The following formula calls for silica, and is one of the best we have. Mix together two parts of best coach japan, and three parts of pure raw linseed oil, each by weight; take pulverized silica enough to form a stiff paste, and, if possible, run the mass through a paint mill, to thoroughly incorporate the ingredients. If this cannot be done, then work the mass in a vessel, then work further on a stone or board, the idea being to get the ingredients perfectly mixed. Coloring may be added before the mixing, if color is desired. For use the paste must be thinned down with turpentine to the required consistency. Such a paste filler is about what one might buy ready-made and sold as first-quality. China clay is sometimes added to the silica, or in some cases the clay is the only pigment used; it is not as good as silica, however.

Some Commercial Filler Formulæ.— It is well for the workman to understand all things that pertain to his calling, having a good working knowledge of the things that he uses, as well as of the manner of their using. Hence it will interest and instruct him by giving the following factory formulas for fillers; it will show how other pigments, not as good as silica, are used.

HARD WOOD OR PASTE FILLERS.

Barytes Filler.— Barytes 50 lbs., raw linseed oil 1 quart, very strong japan drier 1 quart, turpentine 1 quart, water 1 quart, brown soap 6 oz., borax 1 oz. Add soap and borax to the water and mix together thoroughly; then add this to the other liquids, and stir all together.

A "Best" Hardwood Filler.— This has been described by an expert as being the best possible hardwood filler: Finest pulverized silica 100 lbs., powdered soapstone 3 lbs., Vandyke brown 3 lbs., burnt sienna 1½ lbs., burnt umber 2½ lbs., raw linseed oil 2½ gals., grinding japan 1½ gals., thin strong driers 2 gals. It will be noted that the formula calls for coloring matter, and these colors would indicate a filler for oak.

Light Paste Filler.— This filler is composed of 25 lbs. of the best floated silica, and China clay 8 lbs., mixed to paste form with 4½ gals. pure raw linseed oil and 3 pints of the best liquid driers. It is perhaps one of the better grades of commercial filler. In making our filler we would, of course, omit the China clay.

Car Painter's Filler.— Dry white lead 100 lbs., best whiting 100 lbs., Keystone filler 100 lbs., fine silica 50 lbs., dry lampblack 5 lbs., coach oil 7 gals., raw linseed oil ½ pint, turpentine 2 gals., Kauri mixing varnish 2 gals.

Cornstarch Fillers.— Cornstarch was used as the basis of wood filler before silica was thought of. Its main disadvantage is its liability to be influenced by moisture and to swell; it being a vegetable matter, it is liable to decay, hence, in every way it is poorly adapted for the purpose of filling woods. Yet there are some workmen who prefer it. An expert finisher sends us the following formula for what he considers to be the best. Take a pound of cornstarch and ½ pound of flour pumicestone, and mix to paste consistency with ½ pint boiled linseed oil and ¼ pint shellac varnish. Add any coloring desired.

Some finishers like a filler made from equal parts of boiled oil and japan thickened to a paste with cornstarch, and reduced with turpentine to a working consistency. Some use equal parts of boiled oil, japan and turpentine. A good way is to pour the mixed liquids over the starch,

and let it stand over night, or a half-day, covering the mass well to prevent evaporation of the turpentine. In this way the liquids permeate the mass perfectly, so that it is then very easy to stir it up to a paste form. If this filler dries too rapidly add a few drops of raw oil. If it is too thick, add a little turpentine or benzine, the latter often preferable because it enables you to easily spread the filler, and when the benzine goes the filler is as heavy as originally, or before the benzine was added.

A starch filler, in which cooked starch is used, is here given. Mix together one quart each of raw and boiled oil, gold size japan, and turpentine. Boil some cornstarch and while boiling add to it a little magnesia; say two ounces to the pound of cornstarch. Let the starch boil well for at least fifteen minutes. Any coloring may be used, and silica may replace the cornstarch if desired.

FILLERS FOR UNUSUAL JOBS.

Marble Dust or Plaster Filler.— Take marble dust or plaster of Paris and make into a paste with equal parts of turpentine and japan, the addition of a very little raw oil making the mass work easier. As too much japan will not do, it is better to add only a part of the liquid named at first, trying the mass to see how it sets, and adding more japan as may be required to cause setting in proper time. Some add a little dry litharge, saying it improves the filler. Stain may be added if required. Use dry pigment. When the filler is dry and hard in the wood it may be rubbed down.

Wax Hardwood Filler.— Take equal parts of raw oil, gold size japan and turpentine, and mix with beeswax at the rate of four ounces of wax to the quart of turpentine, the wax being first dissolved in the turpentine. Now stir into the wax enough fine silica powder to form a paste, rather stiff, which should then be run

through a hand paint mill or fine sieve; thin up for use with turpentine.

Filler for Very Open Wood.— Such wood as chestnut will require a stiff paste filler, though this wood, as well as similar open-pore woods, can very well be filled with the ordinary paste filler. Mix some cornstarch with shellac varnish on a marble slab or wooden table, making the mass quite smooth. Apply to the wood rapidly, as it sets soon, and after it has become hard-dry it may be sandpapered. The filler must be well worked into the wood, in order to fill the larger spaces. Wheat flour will do in place of cornstarch. The finish over this filler may be made as fine as French polishing, as it fills perfectly and makes a solid surface.

Glue Paste Filler.— Set a pound of good glue in seven pounds (nearly a gallon) of cold water. After the glue has swollen up fully, which will require about one-half day, or over night, set it in another vessel containing hot water and set on stove and boil until all the glue is dissolved. While hot add to the glue from one to two pounds of dry powdered litharge, and two pounds of plaster of Paris; mix well together.

Non-Shrinkable Paste Filler.— Mix a batter of flour paste in the usual manner, and boil it. After it has boiled enough set it away until cold, and the best condition for it to be in when cold is stiff, yet not so stiff that it will not run from the board when mixing it. Then mix in another vessel raw linseed oil and gilder's whiting to the same consistency as the flour paste, then mix the two masses together; add japan driers enough to make the filler dry right. Then for use thin up with benzine. You may not be successful at the first attempt, as the filler has to dry just right, harden, and act the same as ordinary silica paste filler. Proportions given may be varied, for different samples of the ingredients will vary.

Lime and Flour Filler.— Mix a pound of powdered

lime and two pounds of rye flour to a stiff paste with common varnish. Color may be added if desired, using dry pigment.

A Compound Paste Filler.— Mix together one pound of cornstarch, half-pound of pulverized pumicestone, very fine grade, one gill of shellac, one-half pint of boiled linseed oil, and a gill of brown japan. Color if desired.

Silica Filler.— Take 25 lbs. floated silica, 4 lbs. China clay, 3 quarts raw oil, and same of best japan. Mix and run through hand-mill, or mix thoroughly by hand.

To make a smaller quantity of silica paste filler mix 4½ lbs. silica to a paste with a mixture of a half-pint each of raw oil, pale drying japan, or preferably japan gold size, and turpentine.

Adding Color to Fillers.— It should be stated here, for the guidance of the inexpert, that in proportion as we add any coloring pigment we weaken its filling qualities to that extent, some colored fillers containing as much as twenty-five per cent. of coloring matter, making it difficult if not impossible to properly fill the pores of some woods. As a rule, the less coloring matter the better the filler, yet it is necessary to add color in some cases.

In coloring a filler to match a certain wood, add the color gradually, trying the same from time to time by comparison with the wood. It is advised to have the color of the paste filler a little darker than the wood, for the wood itself darkens a little with time. While the ready-made fillers usually answer, yet for a very dark wood you had better make the filler yourself.

The way to color filler is this: Take the lightest color first, if more than one is to be added, and mix with some oil, then take the darker color and mix with a little turpentine, adding it to the oil mixture and mixing both together. Then mix in the rest of the thinners. If cornstarch is the base, pour the liquid over it and let it stand

until it has permeated the mass, which will make the mixing easier. Make paste filler stiff, so that it may be thinned down when wanted; the idea being to save on the volatile liquids, which would evaporate if allowed to be in the filler long before using.

Some finishers use a broad-bladed knife for scraping away surplus filler, pressing the stuff well into the wood at the same time, but the more general way is to use burlap, etc.

When the paste filling has become too hard for removal, but not dry, wet it with turpentine, which will soften it sufficiently to render removal easy. Or you may wet the rubbing pad with turpentine, when the stuff is not too hard-set.

As a rule, close-pored woods cannot be filled with a paste filler, yet when a colored paste filler is applied to a burl or curly wood, like North Carolina pine, for instance, the effect is a very pleasing one.

Table of Colors used in Paste Fillers.— The following list will be found useful for reference when you have to color a filler for matching any of the woods listed here:

Light Oak.— Raw sienna or ocher.

Dark Oak.— Burnt umber, or drop black, or the two mixed.

Golden Oak.— Burnt umber, or asphaltum varnish, or both.

Walnut.— Burnt umber enriched with a little Venetian red, or with rose pink. Black walnut is best filled with paste colored with Vandyke brown.

Mahogany.— Burnt Italian sienna, rose pink, and a little drop black.

Redwood.— Burnt sienna and a little rose pink.

Brazil Wood.— Rose pink.

Cherry.— Burnt sienna, or Venetian red.

FILLERS FOR VARIOUS WOODS.

Ash.— This is a very open-pored wood, and light of color. Mix together two parts of bleached linseed oil, three parts of pale japan gold size, and one part of turpentine, and add fine silica to form a paste. Thin for use with turpentine.

Butternut.— Same filler as for ash or chestnut.

Beech.— Same filler as for birch or red gum.

Birch.— Surface with white or bleached shellac, one pound of shellac to the gallon of alcohol being right.

Cherry.— Best whiting 5 lbs., plaster of Paris 2 lbs., dry burnt sienna 1½ oz., dry Venetian red 1 oz., boiled oil 1 quart, turpentine 1 pint, brown japan 1 pint. Silica may be used in place of whiting, but the whiting enters the wood best, and there is enough plaster to make up the coarse material needed.

Cypress.— This is a close-grained wood, and may be filled or surfaced with a heavy coat of shellac, or liquid filler, depending upon quality of work required, the shellac giving the better job, and two light coats are better than one heavy coat.

Chestnut.— A very open or coarse-grained wood, and requires stiff paste filler, the filler not requiring to be stained, unless in some particular cases, and then merely to match the wood as it will naturally be, whether light or darker.

Elm.— A coarse-grained wood, requiring the same filling as chestnut.

Ebony.— Make the filler from dry lampblack and plaster of Paris, mixing to a paste with brown japan or gold size.

Maple.— Surface with white shellac.

Mahogany.— Take equal parts by weight of best whiting, plaster of Paris, fine pumicestone powder, and litharge, to which may further be added small amounts of

soapstone and also Vandyke brown, burnt sienna and ocher. Mix to a paste with 1 pint of japan, 2 pints of boiled oil, and 3 pints of turpentine; grind in a hand mill.

Oak.— For uncolored natural finish use silica mixed with one part raw oil and two parts turpentine, with japan sufficient to dry. Another formula is: Best whiting 5 lbs., plaster of Paris 2 lbs., dry burnt sienna ½ oz., raw oil 1 quart, turpentine 1 pint, white shellac 1 pint; mix intimately together. This will be the better of the two for oak having just a little color. For *Dark Oak* the filler described for ebony will do, or burnt umber may be substituted for the lampblack. *Golden Oak.* To 10 lbs. natural paste filler (that is to say, filler that has not been colored) add 4 oz. dry burnt umber and ½ pint best asphaltum varnish; mix to a paste.

Rosewood.— Use the paste filler indicated for mahogany.

Red Gum.— Same treatment as for birch.

Sycamore.— Same as for maple, only using orange shellac instead of white shellac.

Redwood.— Cornstarch 1 lb., dry burnt sienna ¼ lb., mix with 1 quart turpentine, and add raw oil and brown japan of each one tablespoonful. Mix, preferably in a hand mill.

Walnut.— Mix together equal parts of China clay and rye flour, coloring to any desired depth with burnt umber, and mixing to a paste with a thinner composed of two parts each of turpentine and japan gold size and one part boiled oil. See also Walnut Finishing.

White Pine.— Surface with white or bleached shellac.

SOME NOTES ON FILLERS AND FILLING.

Pulverized silex should be quite dry before being added to the thinners, and to insure this it should be put in an oven for a time.

The filler should be made to fit the particular wood you have in hand. It should be neither too thick nor too thin. A too-heavy filler causes rough finish. A smooth beginning insures a smooth ending.

Two thin coats are better in all cases than one heavy coat. The two coats should be applied 12 hours apart.

You can coat over the filler in twelve hours, but it is better to allow twenty-four hours.

A shop rule is, from twelve to fourteen pounds of stiff paste to the gallon of thinner.

After filling the wood, wait until the filler turns a lusterless white, then proceed to wipe off across the grain of the wood. Drying requires about twenty minutes.

A paste filler should fulfill these conditions: It should fill the wood perfectly, should be solid and indestructible, that is, not easily influenced by moisture or atmospheric conditions, it should unite readily with the wood fibers, so that nothing can disturb it as long as the wood remains good; it should be translucent, so as to show up the color and grain of the wood, it should be simple, cheap and easily applied, and of such a character that it will never cause swelling and subsequent shrinkage of the wood. Cornstarch does not fulfill these specifications. Whiting, China clay and similar substances do not answer the purpose, being opaque, hence obscure the beauty of the wood. Umbers and siennas are not positively bad, but they will not do on any light woods, nor do they develop the grain of other woods. Too much oil is bad in a paste filler, as the oil shrinks in time, and the filler falls away, causing a marred surface. Silicate of soda is a chemical compound, and soon loses its character and disintegrates. Silex is undoubtedly the best substance yet found to form the base of a paste wood filler, being, when pure, perfectly translucent, and it can be ground to an impalpable powder, but will still retain its crystalline formation, an important consideration, as has been explained in an-

other part of this article. Silica also has an affinity for oil and japan, which are necessarily a medium for its application.

Sandpaper and its Using.— Work that has been made smooth on the sandpapering machine is all right for close-grain woods, especially on large surfaces. But soft wood or open grain woods do not work out as well, because the soft fibers of wood fill up any open places and cause trouble afterwards, after the finishing is done. All open pore woods that have been run through the sander should be made smooth with No. 1 sandpaper, rubbing across the grain of the wood. Give the work a thorough dusting off before filling it.

Often a sandpaper block is useful. This is a block of soft wood of about 2½ by 3½ inches, to one surface of which is glued a piece of rubber packing, or other suitable sheet rubber, and when the glue has become dry the block is sawn into a series of slits, which are about 3/16 inches apart, and sawn to within ⅛ inch of the rubber. The slits make the block flexible, so that it will fit into any concaved surface, etc. Another block may be made, solid, for sandpapering on even surfaces.

Partly worn sandpaper may be used for some purposes, say for rubbing down the filling, but better than this are two pieces of fresh sandpaper rubbed together, which will remove most of the grit. Then apply a little raw oil to the face of the paper, which will tend to prevent the possible scratching of the work. Sometimes a piece of coarse canvas is used in place of sandpaper. No. 0 glass paper is preferred for rubbing down filling. Glass paper is of a better quality than common sandpaper, and is also more lasting. Good sandpaper may be split in two, making a thinner paper for getting into moldings, etc. Poor quality sandpaper will not allow of this splitting.

To cut a sheet of sandpaper fold it evenly with the sand inside; never fold it the reverse of this way, for

that will crack the paper. To prevent sandpaper from slipping under the hand, chalk the back of it. To cause it to cut faster, apply benzine or turpentine to the sand part.

The fuzz raised on the wood by the staining is easier to remove by sandpapering immediately after the filling than at any subsequent time. All liquid-filled wood should be sandpapered, in order to make a smooth surface for the varnish coats.

Keep your sandpaper in a dry place. If damp, dry it before using. Save partly worn pieces for work requiring fine paper. Sandpaper bare wood only with the grain, and in some cases, if not in all, it is best to do this with filled wood, as it is easy to cause scratches, which are difficult of removal.

FILLING WOODS WITH LIQUID FILLER.

What is known as liquid filler is simply a varnish, and not really a filler at all. The only difference between it and varnish is that it contains some pigment substance, and to this extent, perhaps, it may be called a filler. Even so, it is more properly a "surfacer," forming a hard surface for upholding the subsequent varnish coats. True, some of the filling gets into the wood, if any spaces admit of it. But its true purpose is to surface those woods whose structure will not admit of the entrance of a base filler, or one containing silica, etc. The effect of this surfacer is to saturate the tissue of the wood, while the more solid parts remain on the surface. Sometimes liquid filler is applied over a paste-filled surface, in order to saturate any woody tissue not already satisfied. This prevents the sinking in of the varnish coats, and in that way makes a better finish and saves varnish.

There is a number of liquid fillers on the market, but all are essentially a varnish containing more or less filling

material, the best being silica. There is no better surfacer, however, than shellac varnish, containing no pigment or filler material. But shellac is much costlier than ordinary varnish liquid filler, hence is not often used for surfacing, and then only for certain kinds of woods and particular jobs. Shellac dries quickly, sandpapers easily, and gives a very fine foundation for the varnish coats. Liquid filler does not flow out so well under the brush as shellac, but leaves more or less of ridges, this according to the quality of the liquid and manner of its application. Such a surface is very difficult to rub down smooth and level. As a rule, it is not rubbed down, or at most very little, as liquid filling or surfacing is mostly done on the cheaper grades of work. A heavy coat of this liquid filler and a coat or two of common copal varnish without any rubbing down is a quite common method of cheap wood finish. Not infrequently, too, such woods as oak and chestnut are filled or surfaced with liquid filler, but the results are far from satisfactory, though cheap.

Liquid filler should be applied like ordinary copal varnish, in full coats, flowing it on and leveling it out so as to produce as level and smooth a surface as possible.

Silica paste filler may be thinned down with varnish for producing a liquid filler, but where color is to be added it is better to use as the base something of lighter gravity, such as cornstarch, for the silica is so heavy that it would sink down and allow the pigment or coloring to remain in suspension, so that the mass would not be uniform when being used. That is to say, when the filler is applied the silica would fall down into any pores, while the coloring would remain on the surface, this producing a painty effect. Such substances as cornstarch, terra alba, talc, whiting and barytes have the fault of fading out or whitening in the wood, which is a very serious defect where coloring is employed in the filler. Carbonate of magnesia holds up well enough, at least it does not pre-

cipitate as silica does, and the same claim may be made for some other substances that are used in place of silica at times. Cornstarch makes a fairly good filler, many finishers prefer it to any silica filler, but it is hard to make a filler of dry starch and varnish that will keep good for any reasonable time before using it. Raw starch shows up in the pores of the wood worse than whiting, which is bad enough. To a minor extent even silica shows up white, though not to anything like whiting or the other named substances. Boiled starch is better, being more transparent.

Starch is soft and easily applied, hence enables the finisher to rush his work through faster, and this is the best and most we can say for it. It does not hold up the varnish coats well. It seems to fill the wood well, when applied, and to a certain extent it does the filling perfectly, but as it dries it hardens and shrinks, leaving the wood but partially filled. Moreover, this filling takes a long time in hardening, so that as a rule the varnish is applied too soon, the result being seen in after days in the poorly filled finish, the varnish only serving to intensify the effect. A small microscope will show this perfectly, although the eye alone discerns it.

Silica can be pushed into the pores of the wood, making a solid surface, and as it is non-absorptive it does not rob the varnish of its liquids. It has two distinct faults that should be mentioned here; it settles badly in the pot after mixing, and it dries out most too rapidly on the work. The first fault is not a serious one where small quantities are used, as it may be mixed and used at once, but in the furniture finishing room, where it is bought by the barrel, the matter is serious. The addition of a very little raw linseed oil retards the drying, and some finishers use a great deal of oil in the thinning, thinning entirely with oil, in some cases. Yet this quick setting is evidence of durability, and as a general thing there is

no objection to it, as it enables the finisher to expedite his work. He likes it to set fit for rubbing off in from fifteen to twenty minutes.

Where fillers are bought by the barrel, the latter should be kept tightly covered, to keep out dust, and prevent the too rapid evaporation of the volatile liquids. It should be treated as carefully in this matter as the barrel of varnish.

LIQUID FILLER FORMULAS.

Silica Filler.— Mix up four pounds of silica paste filler with one gallon of coach varnish, thinning down with turpentine to the usual consistency of liquid filler. Or, mix together equal parts of raw oil, gold size japan, and turpentine; add silica to form a paste, and thin down for use. In making up such fillers see that the solids are worked perfectly smooth, and if you have a small hand mill to run the mass through better results will follow.

China Clay Filler.— Mix together a gallon of pale, hard-drying carriage body varnish, and a pint each of turpentine and pale japan. Take two and one-half lbs. of the China clay and add enough of the mixed liquid to form a paste, which then should be run through a close-set hand mill and then the rest of the liquid should be stirred in. Stir briskly and until perfect mixture ensues. This formula may be used for a paste filler by not thinning.

Transparent Liquid Filler.— Some woods, the white or very light ones, require a very light-colored filling, and in some cases a transparent filler is best. This latter may be obtained by mixing together eight oz. each of cornstarch and powdered pumicestone, adding a fourth of a gill each white shellac varnish and boiled linseed oil. Mix well together and thin for use.

Imitation Shellac.— A wood finisher tells me that this

imitation shellac is not only cheaper than real shellac, but that it is better in other ways. He takes equal parts of raw oil, turpentine, brown japan and rubbing varnish, adding cornstarch to give it body. It is made rather heavier or thicker than ordinary paint, but not too heavy for easy application. After it has set sufficiently he rubs off with coarse cloth, same as paste filler, rubbing it into the wood, and giving the work two coats.

Another formula calls for four pounds of finely pulverized and floated silica or China clay, the former to be preferred, and one quart of japan, beating the mass until perfectly mixed. Now add, still stirring the mass, six quarts of the best light hard-oil finish, or other good varnish of equal quality, after which allow the mixture to stand an hour or so, then run through a fine sieve. Thin up for use. May be used as paste filler by adding less liquid.

Oil-Thinned Filler.— I have spoken of oil being used in a filler. Many of the best yachts are said to have all exposed woodwork coated with oil-thinned filler, after which the varnish is applied; an elastic spar varnish is generally employed. Several coats of varnish are given, each coat having ample time for drying, and each being sandpapered smooth. The process requires much time and labor, and in consequence is expensive, but the increased wear of the finish justifies it. Some steamships have all exposed woodwork treated this way.

SURFACING OR PRIMING WOODS.

I have treated this subject to some extent under the head of liquid filling, but it seems desirable to have one place set apart for the special consideration of surfacers and primers. Surfacing is also known as priming, and the terms are used in factory finishing rooms.

As previously stated, shellac varnish makes the best

surfacer, but any good grade varnish will do, though it must be thinned well. Usually, a surfacer is intended to follow the filling, to hold out the varnish coats, but surfacing is sometimes done as a filling. The surfacer should never contain any rosin, for the rosin will cause trouble under any varnish placed over it. Some finishers do not like to place shellac under varnish, saying that varnish will not stick over it, but this is probably true only in some cases. If the shellac is well rubbed down it will hold any ordinary varnish.

By adding one pound of pulverized silica to the gallon of varnish you will have as good a surfacer as can be made. Thin down to about the consistency of shellac. This surfacer flows out well, spreads well, and sandpapers easily. Let it stand forty-eight hours before sandpapering. Over it apply one or two coats of good varnish; and, by using the proper varnish, pews and seats may be made to stand well, where so much trouble is had with sticky varnish. The silica causes the varnish to dry dead-flat, giving a rock-like surface. Another cheap surfacer may be made as follows: Take one gallon of pure Damar varnish and add to it a gallon of turpentine. This surfacer was once used on some church work, where liquid fillers used stained more or less, while the Damar surfacer remained perfectly colorless and did not require any sandpapering. Two coats of varnish on this Damar surfacer gave a good finish. Water is a bad element in a surfacer, raising the grain of the wood, and some liquid fillers and surfacers contain some water, enough to raise the grain.

Previous to the 'Seventies liquid and paste fillers were not common, if known at all. I have filled walnut work in those early days by varnishing the wood and rubbing the varnish into the pores of the wood by means of a soft wooden paddle, like a chisel in shape, and this process was repeated several times, or until the wood became filled

with the varnish gum, and bore out the finishing coat of varnish. Such a process involved time, labor, and the use of expensive varnish coats.

HOW TO FILL AND FINISH THE WOODS.

Ash.— Being a very open-pored wood it must be filled with rather stiff paste filler, and as it is a light colored wood too, the plain, uncolored filler may be used. The finishing is the same as that followed for oak, which see.

Butternut.— Same filler and finishing as for ash.

Beech.— It may be finished natural or be stained walnut, cherry, or mahogany. There is a curly variety, and the quarter-sawed is also handsome. When finished in its natural color it should have a full gloss. If stained, let the stain be water color, though many prefer a spirit or chemical stain in oil. It is a close-grained wood, and does not take stain easily, on account of its delicate markings being easy to obscure. Hence a transparent stain is best. If pigment stain is used it should be wiped off carefully as soon as applied.

Birch.— When it is desired to imitate other woods the red birch is best adapted for the purpose, particularly the curly variety. It may be made to imitate mahogany, golden oak, green oak, and a rich chocolate brown. The natural finish of either red or white birch is very fine, and they should have a finish coat of varnish with its luster removed by rubbing. Some finishers say the wood is spoiled by staining. It is a close-grained wood, hence requires a surfacing with shellac, bleached for the natural, and orange for the colored wood. One formula calls for a pound of shellac to the gallon of alcohol, but some use as much as five pounds to the gallon. Your judgment must be used. While paste filler is not required by a close grained wood, yet with birch some think a paste filling best, for it will minimize the effect of water stain

on the grain of the wood. After twenty-four hours sandpaper well, then give it a coat of primer, tinted to required shade with a lake color. In twenty-four hours sandpaper again and flow on a full coat of the best pale cabinet polishing varnish. Finish by polishing, as described in another part of this work.

Usually, there are three finishes, golden, golden red, and dark red. For the golden finish use raw and burnt sienna, and a touch of lemon chrome yellow. Mix these pigments with the first-coater or surfacer, follow with a second coat of primer or thin varnish, and finish with a coat of polishing varnish, which polish as desired. Perhaps a finer effect can be made by using red and yellow lakes; these will show a color-tone the same as the other pigments, with the difference that the coloring will be transparent, leaving none of the little flakes of color seen after using the other method. The light red may be made from burnt sienna, and the dark red from burnt sienna and Vandyke brown. These are also sometimes applied as a stain, being made quite thin with turpentine. In some cases the pigments are combined with the first-coater. The latter way is perhaps the best; but as in the former case, it is best to use transparent pigments.

To stain dark birch mahogany color, first apply a weak solution of bichromate of potash; let it dry, then apply the stain made as follows: rose pink, Vandyke brown, and burnt sienna, in such proportions as will give you the desired color. Apply the stain, and when it is dry sandpaper lightly with fine paper; then shellac it, adding a little Bismarck brown to the shellac, enough to tinge it, which will impart a more uniform coloring to the surface.

Birch may be made to imitate cherry or walnut. The last coat of varnish may be rubbed with o or oo pumice-stone flour, using oil, not water.

A birch door stained mahogany makes a very beautiful effect in connection with white woodwork. Some prefer

this to real mahogany, particularly when the curly birch is used.

Oil stain is liable to obscure the grain of the wood, and the rose lake will fade out. Water stain is upon the whole much better than oil stain, as it takes the stain deeper into the wood, and does not rub through as oil stain will at times. Some prefer an oil stain, however, using burnt sienna, burnt umber and rose lake, in suitable proportions.

After staining the work, rub lightly with fine paper, and give it two coats of shellac, which rub down nicely. Then apply two coats of varnish, and finally rub with flour pumicestone and oil, to a dull polish. The first coat of varnish may be rubbed out with a wad of curled hair, which is better than sandpaper, as it will not cut the varnish around corners, etc.

The foregoing is especially adapted for finishing birch doors, and it is always necessary to shellac before varnishing in order that the varnish may be borne up, otherwise it would sink into the wood, which is more or less open through the action of the stain.

Birch is called a treacherous wood, because of a chemical action which takes place between the wood and most of the stains, this action showing up sometimes in less than a year, when it will exhibit a dirty brown.

Cherry.— It is necessary to make cherry perfectly smooth and free from dust, if we hope to get a first-class finish with it, as every speck shows up in the finish. It is very seldom finished in the natural, although such a finish would be handsome enough, but stain makes it even more attractive. The stain is made from burnt sienna, but aniline dye, particularly Bismarck brown, gives it a good color, but not so durable as the earth pigment. Some vegetable stains, like alkanet root or dragon's blood, make a very good color.

In the using of water stain on cherry there is the danger

of laps showing, spoiling the work. When this happens you can remedy the evil by wetting the edges of the laps with clear water, also the adjoining parts, and then apply the stain. Apply stain freely, but be careful that no air-bubbles form. Cherry takes mahogany stain very well, being one of the best woods for the purpose of imitating that fine wood. In the filling, while some use a paste filler at first filling, such as has been described in a previous place, yet the most of finishers apply only a surfacer, usually shellac. In this way it may be finished just the same as maple.

Cypress.— This is perhaps the most difficult of the woods to finish. It is difficult to dry cypress perfectly, but once it is dry you may find it as little trouble as almost any of the woods, the trouble coming when it is not dry. In this undry condition the application of water stain causes the grain of the wood to rise up. In general the treatment of the wood is the same as that for cherry or birch. First coat it with shellac, then when dry sandpaper it, and follow with two or three more coats of shellac, and sandpapering. Never apply a drop of oil to the bare wood. The wood contains some sort of oily gum, and in some instances as many as three coats of shellac have failed to hold back this oily gum. An application of benzol would no doubt do good. Some advise mixing a stain with strong vinegar, following with a thin coat of shellac, then a coat of copal varnish. If water stain is used it is best to first apply a size of gelatin glue, or a coat of thin shellac. As water stain will raise the grain of the wood it might be better to employ a turpentine stain.

Cypress is sometimes used for making imitation oak, of the Mission color and finish, but the wood must be straight of grain. The stain is made from japan drop black with a touch of rose pink; mix with some inside varnish to form a paste, rather thick, then thin out with

turpentine to form the stain; strain it through cheesecloth. The shade of color may be made lighter or darker by either thinning it more or adding more black. A greenish effect may be had by omitting the rose pink and substituting dark chrome green for the black. Imitation antique oak may be made by using a stain composed of two parts of Vandyke brown and one part of raw umber, with a little drop black also, all these colors being ground in japan. Mix to a paste with varnish and thin out with turpentine. The finishing in either case may be done in varnish, which may be rubbed down, or flatting varnish may be used, as also wax finish.

Chestnut.— This coarse wood is filled and finished about the same as the oaks. It requires a rather stiffer paste filler than oak, but may be finished otherwise the same.

Elm.— This wood has a large pore, although not as deep as that of oak or ash, and it is easier to fill than those woods. But it presents one problem in its so-called whiskers or fuzz, which catches the filler and causes an uneven, muddly effect. The following method for finishing is here offered as one sure to give satisfaction to the finisher. Instead of filling with paste filler use the following materials and methods. First prepare a liquid surfacer by breaking up some silica filler of medium antique oak shade, in turpentine, not benzine, which would evaporate too quickly, and also cause brush marks. Mix together as much of this filler as of liquid filler, then add half as much turpentine as you have of the two mixed surfacers or fillers. Stir the mass well. You may now make any desired change in the color by adding burnt umber or burnt sienna, or both. Apply this liquid with a flat, chiseled, soft-bristle brush, of about 2½ inches width. Apply the filler carefully, spread it uniformly and evenly, and wipe out the edges. Lay it off as in a staining job, and when done leave it to become flat. This

will follow in about 15 minutes, and then will have a velvet appearance and feel. After standing twelve hours the work may be rubbed off lightly with No. 0 sandpaper, making the surface quite smooth; then apply the primer. After this has stood for twelve hours it may be rubbed down smooth, after which you may apply a coat of rubbing varnish or a gloss coat, as desired.

A good deal of elm is full of sap spots, which will show up lighter than the rest of the work; these spots must be stained. After the work has been filled and sandpapered take a piece of soft cotton cloth and a cup of water stain, using either burnt umber or Vandyke brown, and apply it to the sappy places. This will give the entire job a uniform color effect.

Ebony.— Very little of this wood is handled by the wood finisher. It requires a liquid filler as described in another place, and which see.

Maple.— This is a very light colored wood, varying from gray to near white. The only first-coater for it is white shellac, the number of coats depending upon the quality of the work, as many as four, with a finishing coat of pale copal. The less copal varnish applied the better the result, as the varnish gives it a color that is not desired, when the natural finish is in view. Maple should always be finished with a full gloss coat of varnish, as it looks dead when rubbed down. The wood cannot be made too smooth by the woodworker, and it should be perfectly clean and free of all marks. Staining is very rarely done to maple, but a very fine greenish tint is sometimes given by the use of copperas water. Give the varnish coats plenty of time for drying, never rush maple finishing, if you desire the best work. As the quick varnishes are the dark ones, use the slower ones. Damar varnish or varnish containing any Damar will not do, although it is very pale, for it is impossible to rub or polish it. One coat of the best white copal varnish will

do for the finish. Allow four days between coats, and if desired you may allow the second coat to stand five days, then rub with flour pumice and water, using a piece of felt for a rubber, if a dead finish is desired, or to prepare the surface for the finishing coat of full luster varnish. If the dead effect is desired in its best estate, then rub down with rottenstone powder and water, using a soft felt rubber.

Mahogany.— A wood of coarse grain, hence requiring paste filling. This filling must be done with care, if you would have the beauty of the wood brought out. Fill the wood level full, making a solid foundation, one impervious to any subsequent coating, then shellac it, following this with a rubbing down smooth with fine paper, then give it another coat of shellac, rubbing it down also, following with two or three coats of varnish.

Mahogany is a rather spongy wood, which causes its grain to rise in a fuzz, and in some woods this fuzz is seen to run in opposite directions, adding to the difficulty of both the woodworking and the finishing. The filler gathers about this fuzz, causing cloudiness in the staining. The way to treat these spongy parts is to apply to them a coat of thin shellac, after the water stain has been applied, not before. Then it will be ready for filling. The shellac forms a glaze over the spots, preventing the filler from lodging in the pores of the wood, provided that the cleaning off of the filler has been done properly. Let the filling stand for from twenty-four to forty-eight hours, then rub it smooth with fine paper. Then it is ready for the finishing.

It is best to apply a very thin coat of shellac to this wood, in order to produce an unclouded effect. The filler should be made to match the color the stain is to be.

Usually it is best not to stain mahogany very dark, its natural color being rather light, much like that of Spanish cedar or cigar box wood, but a little stain always improves

its color, making it more uniform. Dark stain is useful in case the wood is inferior of quality.

Old mahogany may be imitated with a solution of bichromate of potash in water, or by fuming it. Weak lime water antiques it, making it rather red. The antique effect may also be accomplished by means of a mixture of two parts of turpentine and one part raw oil, well rubbed into the wood, afterwards wiping it off dry. When dry, apply a coat of bichromate of potash in water, which when dry may be followed by filling the wood with mahogany paste filler, with shellac and varnish for the finish.

A French method for mahoganizing other woods is as follows: Make the surface of the wood perfectly smooth, give it a coat of diluted nitric acid, which rub well into the wood. Next stain with a mixture of 1½ oz. dragon's blood dissolved in a pint of alcohol, filtering the solution, and adding to it one-third its weight of carbonate of soda. Apply this mixture with a brush, repeating the same at intervals until the surface has the appearance of polished mahogany. In case the luster should fail, it may be restored by rubbing with a little cold raw linseed oil.

Fine mahogany is a study in itself. The markings are so delicate and its shades so rich and varied, that special care is required in order to develop all its beauty. If an old mahogany shade is desired use an aqueous solution of bichromate of potash. If a richer color is desired, use a water stain soluble also in spirits, which may be applied to new wood, although some finishers stain after the filling. Sandpaper smooth and apply a coat of shellac. This will bleed the stain again, which in turn will cover the marks of the sandpaper and prevent the oil of the varnish from entering the wood; oil darkens and spoils mahogany. Piano finishers get the very finest effects in handling mahogany, and they never allow oil to get on to the bare wood. Some who are not so afraid of its effect add to the oil about forty per cent. of turpentine, and a

little good japan drier, which carries the oil down into the wood, so that its effect is very little on the color of the wood. However, it is advised to omit the use of oil on this wood, and even shellac may be left out, for it too is objectionable in this respect. Use water stain, and finish with three or four coats of varnish. See Piano Finishing elsewhere.

Oak.— It needs scarcely be said, or repeated here, that all woods require to be made smooth and in the best of condition for finishing. This is of course no less true of oak, a more or less coarse and open grained wood, requiring paste filling. A good filler may be prepared as follows: Take from twelve to fourteen pounds of paste filler and stir it into a gallon of turpentine; fill with this, and then let the job stand until set, when it may be rubbed off with tow or burlap; when the rubber has become full of the filler it is the best possible condition for rubbing. In from twenty-four to forty-eight hours sandpaper with fine or worn paper, and make and keep your work clean and smooth. Make a solid foundation with the filler, and on this place your coats of varnish, according to the quality of work required.

Some experts get what they term a polish finish with only three coats of varnish, but to do this you must have a very clean varnishing room, and that is hard to get. But if you can get a last coat of varnish free from dust or dirt a fairly good, well polished surface may be obtained without rubbing.

A finisher says: "I claim that all golden oaks should first be stained, and that this stain should be allowed to stand from three to twelve hours. I prefer the latter. The stain should not be wiped off but be permitted to become dry. Used thin as it should be the stain will run into the pores of the wood at the end, and the pores will absorb the stain and leave none lying dead at the bottom of the pore; the filler should then be applied. This filler

may be thinned, say ten pounds of filler to the gallon of benzine; its only purpose should be to fill the pores of the wood; it should have only a high-grade drop black as coloring; it should be spread right over the stain and be allowed to remain until ripe enough to clean off. The wiping off of the filler will remove the surplus stain, bring out the flakes on quarter-sawed oak as clean as though shellaced; and on rough, straight-grained wood it will not show cloudy, smeary effects, as may too often be seen on this class of work."

Oak has been finished in more ways than any other wood. A few of these finishes are as follows: Natural, light antique, dark antique, golden oak in various shades, forest green, Flemish oak, fumed oak, Antwerp oak, green weathered oak, cathedral oak, weathered oak, and brown oak. Of colors that have been applied as finishes to oaks their name is indeed legion, and it will be useless to describe them all here. As a rule, it is simply a matter of applying some stain, more or less striking of color, and giving the effect a name. There is, for instance, ox blood finish, a crimson effect, and so on through the long list. It may be said that all such finishes are hardly of any practical use, or that they have won any great favor with people. The principal oak finishes have been the golden, weathered, Flemish, Mission, etc. One of the most important of the finishes is that of fumed oak, and this will have a full description here.

The successful fuming of a wood depends upon its tannin content, as without tannic acid no wood can be fumed. White oak is the best adapted for fuming, and is used when it is possible to get the wood, which is now scarce. The light color of this oak makes fuming most effective, this in addition to the fact that it is rich in tannic acid. Chestnut also is rich in tannic acid, but owing to its color and coarse texture it is not desirable for the purpose.

The advantages of fuming are these: Fuming, unlike staining, does not raise the grain of the wood, and it does not show the mottled effect that staining does under wax finish, wax finish being the best for this effect, making a uniform and even color.

Fuming may be done either in a box or room, according to the size of the object. The enclosure must be air-tight, but a glass-covered opening must be had in either case, so that the operation of the process may be noted, from time to time, according to depth of color desired. Time required depends upon size of box or room, strength of ammonia, and depth of color wanted. The period is approximately between twenty-four and thirty-six hours. To observe the process it is a good plan to have a strip of the same wood that is being fumed inside the box or room, so arranged that it can be withdrawn at any time for examination. This is even better than having a window to look through. As the light wood will look light even after the fuming, as compared with what it will show when finished, it is well to wet the strip, which will give a good idea of its color when finished. This wet color will certainly be the lightest the finish can possibly be.

Before placing the object in the fuming place be sure there are no bits of glue or specks on it, which would prevent the fumes from attacking such places; place every object so that every part desired to be fumed may be fully exposed; see that no part laps or touches any other part.

Fuming is done with strong ammonia, that sold as twenty-six deg. being the kind to use, for the stronger the ammonia the more powerful will the fumes be, hence the quicker and better will it do its work. For a room of 2,000 cubic feet of space a gallon of strong ammonia, placed around in shallow dishes, will do the work. Use in this proportion for smaller spaces. The cost of fuming

this way will run anywhere from twenty-five cents to seventy-five cents, according to the size of room.

Ordinary fuming may be done in about twelve hours, but a much longer time will be required for such dark finishes as the Flemish. There is a patented process that does the fuming in six hours, anhydrous or ammonia gas being applied direct into the fuming kiln. Where much fumed work is to be turned out it is economical to use the ammonia gas, instead of the liquid. This gas comes in cylinders of 50 and 100 lbs. each. The price may be about thirty cents a pound, and the cylinders are charged for extra, $20 each, this being refunded upon return of the cylinders. The gas is used by ice makers and refrigerating plants in general. The gas, by the way, is really in liquid form in the cylinders, being compressed. There is also a kiln made especially for the use of furniture makers, for fuming purposes and the use of the ammonia gas.

After the fuming process is complete open up the room or box and remove the article fumed. Opening the door or windows of a room will soon allow the fumes to escape.

The following description of the fuming process comes from an expert finisher, and contains a few ideas not embodied in the foregoing account:

"The first and most essential thing to do to insure a successful job of fuming is to have the wood properly dressed and cleaned, and it is also necessary that it be sorted, so that each batch will be as near as possible even in grade and color. That having been done, it is then ready for the fuming box.

"The fuming box is made of wood, ten by thirty feet and ten feet high. It has an outer and inner wall with paper between, with a window having a double sash. This window is on hinges; the inner sash is made to open inward and the outer sash outward, and when both are

shut the box is air-tight. A door is then placed at the end, and is made similar to a refrigerator door. A rack is constructed on the inside in such a way that it will hold the wood to be fumed in a position that the fumes can reach all parts.

"An iron drum, which holds about ten gallons of the highest grade of ammonia, is attached to the outside of the fuming box at about the center. A pipe two inches in diameter runs from the top of this drum into the fuming box. The fumes from the ammonia enter the box through this pipe and are regulated by a valve.

"For a light shade of fuming it is allowed eighteen hours' exposure to the fumes, which when taken out, if satisfactory, the wood receives a light coat of wax finish.

"For a dark fume two to four hours' additional fuming is allowed, but when taken out, if it proves to be too light in shade, it is treated to a coat of boiled oil and turpentine, seventy-five per cent. oil and twenty-five per cent. turps, and rubbed with a cloth until dry, which has the effect of darkening it to the desired shade and of a successful finish."

Imitation Fuming.— An easy and quick method for getting the fumed effect without fuming is by the application of liquid ammonia direct to the wood. Use full strength ammonia, or diluted, according to depth of color wanted. The ammonia, however, will raise the grain of the wood, in which respect the process is inferior to fuming.

When using the ammonia for treating wood in the open, do it where there is plenty of free air, the open air being best, with back to the wind or air. Cover the surface quickly and evenly, not allowing one part to dry before treating the adjoining part, for that would result in laps showing. In doing such objects as a chair, for instance, it is difficult to keep the liquid from running over on to another part, a trouble also with water stain. It is best

not to use ammonia too strong as a general thing, but to dilute it more or less.

Imitation fumed oak may also be done with water stain thus: Boil one oz. catechu (gambier) in a quart of water, strain it, and apply hot to surface of wood. When dry brush over with a solution of one oz. bichromate of potash solution in one and one-half oz. water. A second coat of the bichromate solution if the color is not deep enough.

Another imitation is made by a solution of iron filings in sulphuric acid or strong vinegar, diluted to desired strength with water, and applying as many coats as may be required. This stain will impart a silvery appearance to any wood containing tannin.

Ivory drop black in japan, thinned down with turpentine, will give a fumed effect; just before the stain sets wipe it off with a cloth. This will not raise the grain.

Another way is to take burnt umber ground in oil and darken a little with lampblack in oil, reducing the mass to a dull brown with zinc white in oil. Thin it out with a mixture of equal parts of brown japan and turpentine, making a thin stain, which apply freely to the wood. When it has set wipe off surplus and fill with natural color paste filler. Remove surplus filler and finish with wax. This stain also will not raise the grain of the wood.

A green fumed effect may be obtained by using the formula given for the second method, with cutch, etc. The green effect is achieved by adding to the above potash solution a little soluble Prussian blue, just enough to give it a greenish cast.

An effect similar to the fumed effect, but known as antique, is made by spreading fresh lime paste on the wood, allowing it to dry, then removing it by a brush.

All darkening of oak may be said to be imitation fuming, and as already seen, there are many ways for doing this. Potash solution of various degrees of

strength may be used, giving color ranging from a light brown to nearly black. In full strength it gives a very dark red color, a deeper tone than that made by ammonia.

To make cherry or birch a reddish shade apply ammonia solution first, and follow with a potash solution.

To imitate oak on ash, elm, alder, box, chestnut, maple, yew or sycamore, apply a solution of iron or copper nitrate; the acetate of iron is simply iron filings that have been dissolved in strong vinegar or acid. Old nails will do in place of filings. The two solutions may also be mixed and used. The color tones are varied by applying either one of the two, or the two together, and by diluting the same more or less. In any case, such solutions must be used cold. Weak solutions of iron acetate give green shades, and stronger ones various hues of brown, darkening as the concentration of the iron salt increases.

As coloring of oak by other means than fuming and its imitation depends upon staining, the reader is referred to that section of this work for further advice on subject.

Rosewood.— The finishing process is that employed on mahogany, which see. Rosewood has a coarse grain, and needs paste filling, colored to match the wood, and two coats of filler give a better surface than one coat. As the wood is stained, the filler must also be stained. The filler may be made as follows: To 10 lbs. paste filler add 8 oz. burnt sienna, 2 oz. rose pink or rose lake, not so much of the latter, as it is a stronger color and gives a richer and deeper tone than the other; add also ½ oz. drop black, all colors in oil. The stain over this may be aniline blue over a crimson, orange, or yellow stain. Any mahogany stain will do on rosewood, but it requires several coats to get the required depth of color. On such a deep color markings may be made in black with a soft hair pencil, while the imitation feather work may be done with a small

sponge, a feather, a small bristle pencil, and a coarse rubber graining comb.

There are several rosewood stain formulas, as may be seen under the head of staining. Rosewood has an oily gum which exudes even after the finishing has been done, causing the work to become full of minute pit marks, and it is therefore essential that the woodwork be carefully prepared before finishing. It is a difficult wood to work, much more so even than mahogany, being coarser of grain; there is little used now.

Redwood.— Brush the paste filler well into the wood, and in about fifteen minutes rub off in the usual way. After standing twenty-four hours it may be made smooth with fine sandpaper, dusted off, and given a coat of thin shellac, rubbing this with fine paper, then applying a second coat of shellac, after which it is ready for several coats of the best polishing varnish, from two to five coats, according to quality of work required; this for a first-class job. Rub the last coat with flour pumicestone and water after the work has stood to dry, two days at least. Then in twenty-four hours it may be rubbed with pulverized rottenstone and water, let this dry, clean off with water and chamois. Finally, rub with sweet oil, and then clean up with a rag dampened with alcohol, which is called spiriting-off, a work that must be done very carefully, lest the alcohol attack the varnish.

A cheaper finish may be used by simply shellacing the wood and applying one or two coats of varnish, rubbing the last coat enough to remove the gloss, which may be done with hair or any other suitable substance.

Red Gum.—See treatment for Birch.

Sycamore.—Even the plain parts of this fine wood make a good finish, but the quarter-sawed parts are better, but should never be stained, this holding good also with the plain wood. Finish sycamore in the natural. The

finish is the same as that for maple, only a dark shellac may be used, or white if preferred, the orange shellac imparting a very nice color. Make the shellac very thin, as for all hard woods.

Walnut.—Some walnut has a varied coloring in which case stain must be used to make it all even. Burnt umber oil stain is commonly used, but as oil will make the wood very dark in time it is not always the best to use. Certainly oiled and rubbed black walnut is something quite handsome. But it may also be nicely finished with shellac, which will not alter the color of the wood. Over the shellac, varnish may be applied, and French polishing, fully described further on, is the best of all the finishes.

To get a dead effect, fill the wood, then apply three or four coats of shellac, rubbing the last coat with fine pumice powder and raw oil, rubbing with a woolen or hair rubber. Clean up with clean soft cotton rag.

There are several sorts of filling for walnut, some of which seem to have been patented. That which discolors the wood the least and produces the finest finish, and is at the same time the simplest compound of any, is nothing more than fine rye flour mixed with boiled oil, japan and turpentine, the mass being ground in a hand mill, after being slightly colored with burnt umber.

White Pine.— Oil applied direct to white pine will cause a more or less clouded effect. For exterior natural finish someone has advised priming with a mixture of two parts raw linseed oil to one part turpentine. This is said to give a more lasting job than where shellac is applied as the priming coat. However as it is very seldom that white pine is finished natural for exterior use, we need not consider that matter further. Shellac is the logical primer or surfacer for white pine and all white woods. White pine particularly, because the shellac "kills" or prevents the sap and knots from showing through where light staining is done. Two coats may be necessary, both

coats rubbed down with fine paper, followed with two or three coats of pale finishing varnish. When the wood is a little uneven of color, as much of the present-day pine is, add a trifle of color to the first coat of shellac, enough to produce a uniform coloring of the surface. Have surface of wood smooth and clean, remove any finger or pencil marks, etc., apply a coat of white or bleached shellac, rub off with No. 0 sandpaper, dust off, and finish with two coats of pale copal varnish.

It is better to make the wood smooth with the plane, the woodworker's work, than to sandpaper it smooth, for no matter how carefully done, the marks of the sand will show in minute scratches.

Knots that are very dark and objectionable may be treated with a bleach composed of 17¼ oz. chloride of lime and 2 oz. of soda crystals, in 10½ pints of water. The mass should be stiff, in order to make the bleach most effective. After remaining on for a few hours, more or less, it may be removed to show how well the bleaching has been done, and if not enough, then repeat. If done enough, then neutralize the alkali with an acid, and it is done.

There is at times some trouble experienced in stain on white pine, as also on yellow, and this is said to be due to the fact that these woods contain a certain amount of tannin, which injures the light colored stain. It is well known that oxalic acid is made, in some European factories, from pine sawdust. Both white and yellow pine, when dried out, yield ninety-four per cent. of oxalic acid, it is said, while oak contains but eighty-three per cent.

Yellow Pine.— Oil darkens this wood, hence is not to be applied direct. Formerly oiling of hard pine was quite a common method for treating exterior work, as under porches. The result was that mildewing was bad, making the work in places nearly black, and it was difficult to remedy such evil except by painting it. The best way

is to first coat it with white or orange shellac, according to kind of pine, some being much darker than others. Some apply two or three coats of brown japan, when coloring is desired, rubbing the japan into the wood, and removing the surplus by rubbing off with cloths. This filled the tissue and left the heart growths and grain standing out, making a very handsome effect. Sometimes two coats of japan are applied over the rubbed-off japan and left that way, but this makes a dull, lifeless effect. Again, the japan may be applied to the bare wood, one or two coats, and not rubbed off.

Considerable of this wood is finished in house work simply by applying one coat of liquid filler and one coat of hard oil finish. School furniture makers usually size with white glue, followed by a coat of common varnish, then another coat of glue size, and a finishing coat of hard copal or cheap varnish. Often the furniture gets but the coat of glue and a coat of varnish. House painters usually give the wood a coat of liquid filler and a coat of hard oil finish, or where the work is to be done better, more coats will be applied, and they will be rubbed some, with sandpaper or maybe with curled hair or other suitable material. Steel wool is now used extensively in place of sandpaper.

Orange shellac will give some coloring to the wood, but as stated, it depends upon the natural color of the wood and the kind of finish desired. However, orange shellac has better body than the bleached, and on low-cost work at least is most used.

"I don't like to see yellow pine stained a bilious green and called weathered oak; I would plead with you to finish wood in its natural color. In after years it will tone down to its rich, natural hue. I have seen old pitch pine that had acquired a tone almost as rich as mahogany. The sunlight exerts a chemical effect and darkens the wood. Where you go into a room having three or four

kinds of wood you find it difficult to make a stain that will equalize those woods, because the woods are of so diverse characters. But if you will apply a thin coat of shellac to the woods you can then apply the stain and it will be all the same, using oil stains."—*W. E. Hall.*

Finishing Georgia Pine.— In the following we have the methods used by some of our most expert house painters, in the finishing of Georgia pine.

" Clean off all dirt and pencil marks, sandpaper smooth all rough parts, dust off, and apply a coat of white shellac. When dry, sandpaper lightly, apply another coat of white shellac, let this dry, then sandpaper or rub down with pumicestone and water, according to price being paid, or time allowed, and finish with a coat of good interior finishing varnish of light color. Follow this with rubbing down to a surface, and another coat of the interior varnish. Leave it in the gloss, polish, or leave dull finish, as desired. I find that any filler containing oil will turn the wood dark in time."—*W. S. Hopkins,* Cleburne, Texas.

" This wood is easily soiled by dirty hands, also from dust and dirt; it darkens from exposure. Hence I always sandpaper it clean after it comes from the woodworker. Then I dust it off and apply a coat of white shellac. As Georgia pine contains a good deal of rosin which comes to the surface on being exposed to heat, and in some cases in the absence of heat, the shellac will hold that back, harden and hold the soft and porous grain, and retard darkening of the wood by age. Although it is what is called a close-grained wood, it is the better for having a very light coat of light paste filler before the shellac is applied. After the shellac has become dry, fill nail-holes, etc., with putty made from white lead and common whiting putty, colored with dry ocher to match the wood, rub lightly with sandpaper, after shellacing, dust off, and apply coat of good grade pale finishing varnish, reduced a

little with turpentine. Use your judgment about that. When the first coat of varnish is dry enough, say after forty-eight hours, rub lightly with oo sandpaper or steel wool of corresponding fineness, or even with curled hair, dust off, and apply another coat of the pale varnish, unthinned.

" If the work requires a rubbed finish or polish, give it three coats of varnish, rubbing off the gloss of the last coat with flour pumicestone and oil or water, and then polish it. Georgia pine will take a fine finish when properly done, and some fine effects may be had from staining. Sometimes this wood will show up small streaks or spots, and sometimes entire boards will appear as though mildewed, spoiling the whole job. This mostly occurs when the wood is against a damp wall or water pipes, and the only thing to do is to paint the backs of the boards with a coat or two of good hard-drying paint.

" When finishing Georgia pine the wood should be perfectly dry, and the room have a temperature of about seventy-two degrees Fahr."—*F. E. Hollinger,* Detroit, Mich.

" On yellow or Georgia pine I have found that the best results come from using a stain made from the necessary pigments, a little driers, and thinning with benzine, letting this stand for a time, then wipe away all from the surface; for the best clear effect, that will show up the grain best, always wipe away clean. If you do not get the desired color, then you can glaze over with the color you wish. The glaze should be very thin. I do this sometimes when desiring a certain color effect on mahogany, or when imitating that wood on other woods; I stain and shellac, then glaze over that. The glaze must be carefully applied and blended to get a uniform covering, and it must of course be transparent. I have also stained first with a water color, and when dry, with an oil stain, to get a certain desired color effect. The important thing is to

get that effect without impairing the natural beauty of the wood; if anything, this beauty should be enhanced."— *Anon.*

"An architect wanted us to make a black walnut finish on Georgia pine, and we found that Vandyke brown would not do, so we added black to it and made it a very dark finish."

Georgia pine is a very difficult wood to stain without hiding the grain.

"I intend never again to use aniline stains in wood finishing."— *Anon.*

Whitewood.— All white or very light colored woods are more or less darkened by the application of oil, and as regards whitewood the best primer to use is Damar varnish thinned down by adding one part of turpentine to four parts of Damar. This gives a good surface, and preserves the color of the wood. But Damar varnish must not be used in any subsequent coat, as it is entirely too soft; use instead a very pale copal varnish. Usually white shellac is light enough for light colored woods, such as holly, maple, whitewood, and white and yellow pine. The shellac must be well sandpapered, as in some cases varnish does not adhere well to shellac. When shellac is employed two coats may be applied the same day, then a coat on the next day, and so on, a coat a day, until the desired number of coats has been given. Usually four coats are given, the last coat being rubbed down with flour pumicestone and water, rubbing very lightly. Such a method results in a solid and level surface for the finish, with great apparent depth.

Give shellac time for drying, twenty-four hours being right; you may think it is dry when it is only set, and if you rub it while undry you will have trouble.

Whitewood may be stained if it is desired, and a stain and filler combined may be used, for cheap work, by mixing together some raw sienna and whiting, with a very

little burnt sienna, applying this in stain form, but heavy enough to form a thin paste; water color may be used, thinning with glue size. Common furniture is done in this manner. Cheap furniture varnish may do for the finishing.

Finishing Fireproofed Wood.— Woodwork is sometimes made fireproof by means of certain chemicals or salts, which are forced into the pores of the wood by pressure. While these salts remain dry no trouble follows, but should they be subject to the least dampness then any paint or other finish placed over the wood will be injured. These salts act also upon any wood containing tannin, darkening and marring the beauty of the natural wood. In some cases only paint can be employed as a finish.

These salts might be neutralized in some way, but it does not seem that there is any practical way to do it. Probably the best thing to do in the case is to use the best hard copal gum varnish.

The principal chemicals used in fireproofing wood are the chlorides of lime, magnesia, zinc, tin, and ammonia; ammonium phosphate, sulphate of zinc, alum, borax, boracic acid, and aluminum hydrate.

STAINING AND FINISHING HOUSE TRIM.

The following was written by a master house painter:

"For soft woods, such as pine, spruce and basswood, I believe that an oil and turpentine stain alone can be used with success, especially if the stain be applied to the raw wood. We are sometimes called upon to stain pine or spruce (such as in office partitions) a light or dark oak, cherry or mahogany. In this case I find that the stain should be made with a large proportion of oil and driers. There are so many soft places in the pine; if the stain is sharp it strikes into them much darker, but using the stain

oily I find helps to give a more uniform color and also makes a good undercoat where it is to be finished with one coat of varnish.

"Then again, we often find as many as the three kinds of soft woods, pine, spruce and basswood, in one room and it requires good judgment in reducing the stain to suit each wood, causing the man to carry three pots to get something like a uniform color.

"To procure a good uniform color where wood is not first class (very often the case) many parts of the wood being soft and punky, it is advisable to give the work a coating of oil and turps; probably half and half, as one sees fit. In this case a stain containing less oil and more turps can be applied. After the oil coat is dry, and if the work is wiped carefully, a good effect can be had. We find that the pine we get to-day is very seldom fit to stain so as to imitate another wood, and is only good for jobs where it is merely a darkening or coloring of the wood. Whereas basswood or whitewood can be made to represent mahogany, cherry or rosewood, oil stain being preferable.

"Recently in our locality we have had Georgia pine and fir introduced in the finishing of houses. First of all the Georgia pine was used for veranda ceilings, but now we have houses finished with it throughout, and we are just beginning to know how to deal with it and treat it, and the natural finish of these woods is beautiful and very suitable for kitchens and places where a light, bright finish is desired.

"These woods make a nice finish when stained especially in oak and brown colors; also the green weathered effects. The wood is not so well adapted for the red colors, mahogany and cherry. We also find that the wood does not always take the stains alike, and it is necessary to have two pots of stain. Even then the color may not be all uniform, but the effect is pleasing. Stain for this work needs lots of driers and should be wiped over

and generally two coats of varnish will then give a good finish, dull or gloss. One trouble we have been up against which applies to this, as well as other woods, is the doors, which seem perfectly clear and ready for stain, and after staining show up spotty and blotchy, caused by rain or water, and then only a steel scraper will remove them by scraping all the stain off. There does not seem to be any way of knowing whether the spots are there or not until the stain is applied, but as soon as noticed the spots can be sandpapered off before staining. An ordinary scuff won't do, it needs some rubbing.

" The hard woods, oak, ash, mahogany, birch, etc., have a great many stains in the market, and we very often find the architect specifies some particular maker's goods. In that case we have no option but to use them and to follow the directions. The stains I prefer particularly are the acid or water stains and dyes. By them some beautiful effects are obtained, and often desired by our customers, and in most of the effects produced by these stains the wood is seldom or never filled and usually finished with wax or flat varnish. This finish is less expensive than the varnish rubbed finish and may have something to do with their popularity, but when this finish or one of the various effects is desired, I think it is better to use the stain and finish as prescribed by the manufacturer, but when showing the sample and the customer selects, I would let them know that the stain may and may not be the exact shade, but it may get the same after a while. The wood we are called upon to stain may be different from the sample, the sample may be white oak and the work to be stained red oak, or both, causing different shades, making it necessary to tinker with the stain and then, in some cases, it is hardly possible to kill the red in red oak. I do not care to meddle with the manufacturers' stain if it can be avoided, unless by using the different

stains of the same maker. So I think it is better to make an explanation before doing the work.

"To my mind, the best way is to make your stains on the job, show the customer a sample of the work about to be done; be sure the sample pleases him as well as yourself, and very seldom trouble occurs. There is one thing, when we use a manufacturer's stain and finish as specified, if anything goes wrong we can place the trouble with them.

"Oak and ash are open grained woods and to procure a good, solid, lasting job I think it is necessary that they should be filled.

"A stained filler is preferable to staining and filling as it fills the pores up better, and if one can procure the desired color, a stained filler applied to the raw wood, properly filled and cleaned, shows out the beauty of the wood, and gives it a much better surface to produce a polished finish and a durable job.

"Then there is staining of birch. Birch takes a stain well and is passed off and believed to be mahogany with persons not acquainted with woods and the staining of them. In staining birch for dark mahogany, I have generally used a water stain, filled with stained fillers and shellac before varnishing. The water stain raises the grain of the wood, and to overcome this I simply sponge the work all over with clear, cold water and when dry sandpaper it well, while the stain may even then raise the grain to some extent, the stain will stand some sandpapering with fine sandpaper; then the fillers and a coat of shellac will give a good smooth surface to varnish on. But with birch, as other woods, I prefer an oil stain, where the depth of color required can be procured.

"I have had some trouble with mahogany stains or dyes where they were used in conjunction with white (that if a spot of stain got on the white) it was hard either to shake off or cover up, and have known it to

show through several alternate coats of shellac and white paint. The staining of wood is a large subject, there are so many kinds of wood and many kinds of stain and many ways of producing similar effects or results."

THE IMITATION OF HARDWOODS.

How furniture makers imitate scarce and costly hard woods is told in a bulletin issued by the Government, and from which I am privileged to extract the following:

"No set of men appreciate the seriousness of the timber supply question more fully than those engaged in the manufacture of furniture, and assuredly no industry is better prepared technically to meet the condition of the market. They have succeeded admirably in coping with the situation by the economical use of material, by the practice of veneering, and by the successful imitation of the highest priced hardwoods, at the same time keeping up the standard of their product. During the last few years the great increase in the price of hardwood used in making furniture has created a strong demand for woods which can be used successfully in the imitation of the high-priced hardwoods.

"The two woods that are the most often successfully imitated are mahogany and oak, particularly the quartered oak in the golden and darker finishes. Almost without exception, the makers of these imitations, either as imitations, or under some registered trade name, market them as such. He does not try to deceive. For imitating mahogany cherry was formerly used almost entirely. The diminished supply and increased price of cherry led the furniture makers to seek a wood that would lend itself more readily to the stain than cherry, and at the same time hold the gloss and show the grain. For these reasons birch, especially curly birch, maple, beech and gum are extensively used for all parts of furniture. Even in the

better grades of mahogany furniture birch and maple stained to a mahogany finish are often used for the posts and frames, while genuine mahogany in the form of veneer is used for panels, tops and rolls.

" In making imitation quarter oak almost any wood can be used, since in this case the original grain of the wood has been filled, and the quartering is printed on in dark ink by the impression of actual quartered oak rolls or by transfer from quartered oak prepared by special processes. The kinds of wood commonly used for this work are birch, maple, poplar, and plain sawed oak. After the wood has been finished and polished the imitation appears so real that only an expert can detect the difference.

" There are certain woods used in furniture construction which are extremely expensive, owing to the difficulty of obtaining pieces with a good grain of sufficient size for working. Such a wood, for instance, is Circassian walnut. This wood comes from the Ural Mountains, and is largely used in the form of veneers for chair backs, panels and tops of bedroom suites, table tops, etc., the balance of the piece of furniture being either of American or black walnut (natural finish), or of satin walnut, commonly known as red gum. This red gum, while it does not often show the beautiful grain of the panel, is so near the color of the plain Circassian walnut that only close scrutiny can detect the difference in the wood."

IMITATING OAK ON OTHER WOODS BY PRINTING.

The process of imitating woods by the roller process or printing by transfer, was not included in the first edition of this work, though it should have been done, as I had the manuscript copy prepared for use. The description given is so full that the workman will have no difficulty in doing good work by its use.

The Roller.— The roller should be made from strong, light, well seasoned wood. For doing certain parts like window sash or other small parts, make the roller a little greater in circumference than the length of the surface that is to be printed on. This roller may be the segment of a circle of wood, in the form of a rocker, or it may be made in this way: The shaft, extending about four inches on either end of the roller, to use in rolling, contains about twelve and one-half inch spokes, around which bend a strip of quarter-inch gum wood, and form the roller. Make the handles smooth.

The Composition.— Take twelve ounces of raw linseed oil and heat to near the boiling point, then add one ounce of chloride of sulphur; in another vessel dissolve two pounds of the best white glue, and add eight ounces of glycerine; in dissolving the glue use as little water as will do the work. Now mix all together and stir thoroughly.

Here is another method: Dissolve twenty-seven parts of the best white glue and add to it twelve parts of commercial glycerine; add also a small quantity of molasses and raw linseed oil. For a roller weighing say from ten to fifteen pounds, a half-pint each of the molasses and oil will do. To test the composition for consistency cool a little of it, and if it proves to be too hard, add a little more glycerine; if too soft, add a little more glue. Keep the composition hot, it will not hurt it to boil; in fact it is better for it to come to a boil, as the boiling will expel surplus water, which must be removed.

Making Larger Roller.— For a larger roller mold the composition directly on to the roller. Make a circular head of one-inch board three-fourths to one and one-half inches larger than the roller; make a hole in the center of heads, there being two, to admit the shaft of the handles of the roller. Cut the edges of the heads true, and fasten down close to the roller; secure same firmly with bolts

made to hook over the spokes of the roller. Fasten the head down true, so that it will form a flange of equal depth all around the roller. Now turn the roller over, and stop all holes with plaster of Paris; the best way to do this is to run the plaster all around the inside of the roller, for there must be no leaks. In the head of the roller as it now stands upright cut out three or four holes along the edge of the head, about one by two inches, to allow pouring in of the composition, and escape of air. Now take a long and smooth strip of zinc that will be enough to enclose the roller, rub it well with grease, or oil, then place it around the roller, oiled side in. But be sure to get the zinc well oiled, to prevent any of the composition from sticking to it; apply plenty of oil, rub it well into the metal, and rub off the surplus with a rag, then rub it off with your bare hand. A very large roller will require to have the zinc fastened with collar bands. Draw the zinc around the heads of the roller and pour in the composition through a strainer. Let it stand for twelve hours before removing the zinc.

For a Smaller Roller.— For a smaller roller make a light wooden frame of the required size, as a mold, set in plaster of Paris on a piece of zinc or glass; into this mold pour the composition, and on top of the composition lay a piece of canvas. When cool attach to roller or rocker, fastening the edges and ends of canvas with tacks.

Using the Roller.— Now prepare a sample board of the kind of wood that you wish to print from, selecting as nice a specimen as you can, with good markings, and let the board be about six inches wider and a foot longer than the circumference of the roller; dress the wood carefully. Fasten thin strips all around the board, and extending an inch above the board, bore a half-inch hole in one corner, for use in cleaning off the board. Now take half a box of concentrated lye and dissolve it in hot water. Pour this out on the board, allow it to remain about twenty

minutes or so, then run it off and wash the board with clear water until no trace of the lye remains. When the board is perfectly dry smooth it up with fine sandpaper. Then try the board, apply the color, to ascertain whether the grain is sufficiently eaten out for printing; if it is not, give it another bath of the lye. The lye will eat away all the softer part of the surface of the wood, leaving only the harder parts, which is the grain or heart growth. The board is then like a zinc etching.

The Scraper.— You will need a scraper, which may be made in the following manner. Take a piece of clear white pine board ⅞ inch thick, 4 inches wide, and 12 inches long. In one edge of this board cut a groove one inch deep. Set in this groove, with glue, a firm piece of sole leather 1½ inches wide and as long as the board. Plane off the edge of the wood down to the leather to a rather blunt edge, and be sure to get the edge perfectly true. This tool is your scraper, for removing the surplus color from the impression board, or printing block.

The Printing Color.— Water color cannot be used. Use pigments ground in japan, and make the printing color a little thicker than ordinary oil paint. Strain it on to the board, enough to cover well, then spread it out evenly with the scraper, taking the tool with both hands and pushing it before you, pressing down hard. A new board is rather difficult to make clean enough to get a good impression from, so it may be necessary to run it a few times before doing the actual work of printing, to get it clean. The idea is to have just enough color in the pores of the wood to fill them level full, so that a clear impression may be had. After the board has been in use for a time it will clean off nicely, by running over it once. Japan colors are best for making the impression paint, thinning with turpentine to paste form, then adding a little boiled linseed oil, to prevent the color from becoming dry while on the board.

Having coated the impression board with the color, take the roller in both hands; select a point on the roller to start with, then place it down on the board; press down evenly, and with firm pressure roll it along the board until the roller has made a complete revolution, being careful to not go beyond this point, for that would make a lap on the roller; now pick up the roller without allowing it to slip on the board, and place it carefully on to the surface that is to be printed, beginning with the same point on the roller that you began with on the impression board. Roll firmly, evenly, steadily, and never allow the roller to slip. This will produce on the prepared surface a perfect copy of the impression board, the hard parts, uninked, showing clear, the printed parts coming from the eaten out portions.

Care of Roller and Board.— After making the impression clean off the roller with a rag dampened with benzine, then run the board as before, taking another impression, and so proceed until you are done printing. When done finally clean off the impression board with benzine and a stiff brush, leaving not a particle of the color on. Should the board become more or less clogged you will have to treat it again with lye, but be careful to not let the lye eat too long or too much. Finally clean with water, let it dry, then put it away for another job. Clean the roller carefully with benzine and set it in a cool place. A certain degree of heat will melt the composition. Otherwise it will keep indefinitely.

Finishes in Favor.— Among the principal effects that are to-day being largely used are the following:

For Oak.— Natural, light antique, dark antique, golden oak in various shades, forest green, Flemish oak, weathered oak, cathedral oak, fumed oak, Antwerp oak, green weathered oak, brown oak.

For Ash.— Natural, light and dark antique, golden

oaks or brown and black casts, and all colors that are used on oak.

For Birch.— Natural, mahogany, forest green, silver gray.

For Mahogany.— Tuna mahogany, light and dark mahogany effects, all shades, old mahogany.

For Walnut.— Natural, dark walnut.

For Cherry.— Similar to birch finishes.

For Chestnut.— Similar finishes to oak.

For Maple.— Natural, pearl gray, silver gray, mahogany (all shades).

For Cypress, Pine and Whitewood.— Natural, oak, mahogany and walnut liquid filler, golden oak, weathered, Flemish and Antwerp shades, brown oak, forest green, green weathered, etc.

For California Redwood.— Similar to pine finishes.

The Grays in Oak.— Intermingled with the brown-stained offerings so popular to-day and the dark-green of the mission, entering in oak furniture and trim, we have various shades of gray in oak now. These gray shades are not new things, by any means, but there seems to be more successful effort at pushing them than heretofore. The present-day ideas in gray seem to have originated at the great exposition held in St. Louis a little more than ten years ago, where the German contingent showed considerable stuff in gray colors. The first efforts apparently did not meet with very pronounced success, but the idea has stayed with us and is being more industriously fostered to-day than ever before. The gray idea was first used more generally on maple than anything else. There were finishes known as silver-gray on maple even previous to the exposition mentioned. It is an old finish that has been used more or less for a generation or more. This year, however, the idea seems to have gotten into the oak field in various shades and finishes in gray, and the result is quite a mingling of gray effects with the mission and

with the tobacco brown finishes that seem to be more popular at the present time.

Some of these grays are attractive as well as striking in appearance, but all of them are rather cold, and while they may appeal for summer furniture and warm weather, there is not enough warmth about most of them to make them desirable in the winter time. The gray fad is likely to be overdone and bring about a reaction soon, because we not only have it in various shades and grades in the oak itself, but it is to be seen in printed paper imitations of the oak, and it is these that will perhaps serve to turn popular favor away from the grays. For the time being, however, gray is an item in oak finish, and where carefully and artistically done it presents an artistic effect. It is a finish, though, that seems a bit difficult, in that there are only certain shades and effects in it that are pleasing, and so many of the others are objectionable that it is not very likely to remain in popular favor for any great length of time.

WOOD STAINS AND THEIR USE.

Stains for wood finishing may be obtained from both mineral and vegetable substances, and until recent years these were the only kinds known. Now we have the aniline dyes or stains, a valuable addition to our list, and the most extensively used. The anilines are much more fugitive than the mineral or vegetable stains, but offer an almost unlimited number and variety of beautiful colors, in which respect they differ materially from the older stains. Upon the whole, the vegetable stains give more satisfaction than those derived from coal tar, or aniline dyes, yet they are not entirely permanent, but are liable to fade more or less with time. In fact, the action of sunlight upon color seems to be to lighten it. Still, while vegetable and mineral stains do fade more or less,

yet it requires considerable time, as a rule, for this action to be fully accomplished, whereas, certain aniline stains have been known to fade badly within a very few weeks. A finisher tells of a house done with mahogany aniline stain on birch that faded badly before the house was finished. Olive aniline stain has been known to change soon to a dirty reddish-brown. But now it is said that aniline color makers have succeeded in making certain anilines quite light proof.

Vegetable and mineral stains are usually prepared for use with water, but in some cases they are used in connection with oil or turpentine. A water stain is more penetrating than an oil stain, and gives a more solid color, owing to the fact that it carries all its pigment into the wood, whereas oil stain holds some of its pigment and renders the staining more transparent, or less opaque. Water stain raises the grain of the wood more than oil stain. Turpentine and alcohol carry stain well into the wood, but both are more costly than water stain, factors of importance with concerns using large quantities of stain. Oil stain brushes out well on soft woods, water stains do not. Spirit stains sink in too quickly for good distribution of color. On very hard woods an oil stain will not penetrate well, but water stain does. The best mineral or earth pigments to use with oil are Vandyke brown, burnt and raw sienna, and burnt and raw umber. For this purpose the pigments cannot be too finely ground. The pigments suitable for use in oil staining are equally suitable for water stains, but many vegetable, most of them, in fact, are not suited for use with oil. Of the latter may be named here, with further mention in another place, turmeric, gamboge, dragon's blood, etc.

To prepare aniline for staining, those only that are soluble in water will do, of course, unless a spirit stain is desired, there being anilines soluble in oil and alcohol, as well as in water. But those mostly used in wood finish-

ing work are soluble in water. Those soluble in oil do not interest the finisher. They are sometimes used in connection with the coloring of varnish and wax for the family trade in finishes.

Anilines must not be placed in a metal vessel, but in glass or earthenware. To prepare the stain for use where the stain is used day by day, or for other than occasional use, make up what is called a stock solution, by placing an ounce of the aniline to a quart of hot or boiling water, pouring the water over the dyestuff and stirring meanwhile with a wooden paddle or a stick. Soft water is the best. In about one hour the dye may be filtered through a wad of raw cotton, placed in the neck of a funnel, and this in turn in the neck of a bottle. As metal is apt to discolor the dye, better use a glass funnel. Cork the bottle tight and label it with name of dye and strength of solution. When wanted for use it may be diluted in another vessel, or a measured quantity poured out and diluted with a measured quantity of water, all in proper proportion. The rule is, an ounce of aniline to the gallon of water to form a working stain; hence to a pint of the stock solution, as it is called, you may add three pints of water. Use hot water for diluting the stain. Take the cotton from the funnel and soak it in a little water, enough to take up the dye that is in the cotton, place this solution in another bottle, and label it accordingly. The first solution only is the " stock solution." In this way there is no waste of dye, as in daily mixing, and you can have an assortment of dyes on hand, in stock solutions. They will keep good for a long time when not used.

To prepare aniline dye with alcohol, place a half ounce of the aniline in a vessel, glass or earthenware, as before, and pour over it a quart of alcohol, and shake it occasionally the first few hours. Then filter it into another vessel, and finally place it in a bottle properly labeled. It is not really necessary to filter it, but it will do no harm. Filter

paper should be used, if you do filter it, placing a saucer over the paper as it filters, to prevent evaporation.

In the application of aniline stain, whether it be water or alcohol stain, it must be used quickly if you would have uniform coloring of the surface of the work. Especially is spirit stain difficult to apply, owing to its quick setting, and only the expert may do it easily and with success. There is no tool better for applying either of these liquid stains than a small sponge. In order to show any markings the wood may have the stain should be wiped off immediately after application. A stain may be made lighter by dilution, and darker by application of two coats. To appear at their best some woods need two coats of stain. On soft, spongy wood it is better to size the wood with a very thin coat of shellac, before staining it. Some woods are benefited by bleaching before staining, the bleacher being made from chloride of tin 8 oz., soda crystals 1 oz., and water 5 pints. Apply, and after a little while apply a wash of dilute sulphuric acid, then wash off with clear water; then let dry, following with stain.

The raising of the grain of the wood by water stains, and to a less degree by spirit stains, causes annoyance and additional labor to the finisher. One method for meeting this difficulty is something like a vaccination. The bare wood is first wetted with water, to raise all the grain it can, and this, when dry, is sandpapered off, then the stain will not have so much fuzz to raise; that is the idea, and it seems plausible. One finisher advises first treating the wood with a mixture of five parts of benzine and one part raw oil, which he claims is better than the wetting with water, as it not only minimizes the raising of the grain, but it also prevents the too deep sinking in of the stain, giving a more uniform surface. All such ideas of practical workmen are worth trying out. Some finishers add a little glycerine to a spirit stain, or castor oil, but it is apt to cause trouble with the succeeding coat of shellac

or varnish. Yet it is supposed to be the better of the two articles named, and about a tablespoonful of the oil is added to the quart of stain, but the stain must be allowed ample time for drying, before filling or varnishing the work. In the case of finishes like Flemish oak, which are neither filled nor varnished, the oil will do no harm, and a more liberal quantity of it may be used. However, as there is danger in the use of castor oil and glycerine it would be better to try Venice turpentine, say a tablespoonful to the pint of stain.

STAIN FORMULÆ FOR HARD AND SOFT WOODS.

Staining Oak.

To Match Brown Oak.— When it is desired to match brown or pollard oak on common oak the effect may be accomplished with a stain made from an ounce of bichromate of potash dissolved in five pints of soft water, which is a weak solution, but strong enough for the purpose; if not, then make the solution stronger, as desired. Apply with sponge.

Weathered Oak.— Make a solution of equal parts of water and green copperas (iron sulphate). Or iron acetate, which may be made from iron steeped in sulphuric acid and water.

Dissolve an ounce of bichromate of potash in a pint of water, and apply in alternate coats with the iron solution, each coat to be dry before applying the next coat.

Dissolve two ounces each of potash and pearlash in one quart of water; use alternately with a solution of either iron acetate or iron sulphate.

Take of powdered ivory black and Vandyke brown equal parts, and make to a paste with alcohol, making the mass quite stiff, for it must then be made to a less stiff paste with shellac, and for staining thin up with alcohol.

Add a little Bismarck brown to Nigrosine B, and dilute

with water to form the stain. Or dilute with alcohol, which will not raise the grain of the wood as water does. The shellac acts as a binder, giving a near-dead finish, without further treatment. For red oak make a stain more on the blue-black order.

An oil stain may be made from Vandyke brown and ivory drop black in oil, thinned with equal parts of oil and turpentine, or with the latter alone, or with benzine and a little japan.

Bog Oak.— Dissolve two ounces of permanganate of potash in a quart of boiling water; when cold add to it an ounce of verdigris that has been dissolved in strong vinegar or acetic acid. To increase the green color add more verdigris solution; to lighten, add potash solution.

To make bog oak on white oak dissolve an ounce of verdigris in one pint of ammonia water.

Mix with a gallon of ninety-five per cent. alcohol one pound of finely powdered burnt Turkey umber and two ounces of chemically pure chrome green of light shade; shake the mixture occasionally and after twenty-four hours add one pint of shellac varnish, then strain all through a fine sieve.

Mission Oak.— Break up two pounds of drop black (ground in oil), and an ounce of rose pink, also in oil, with a half-pint of best brown japan, thinning the mass with three pints of turpentine, then straining through a cheese cloth. A quicker-drying stain may be made using colors ground in japan, and omitting the brown japan and using instead, as a binder, a gill of copal varnish.

A simpler process is as follows: Mix boiled linseed oil and asphaltum together in equal proportions, and apply as a stain, using a brush. In a minute or two rub off with a cloth, removing all surplus stain, and when dry it may be varnished if desired. One gallon of this stain will cover about 600 square feet of smooth wood.

Flemish Oak.— This effect is nearly black, the wood

not being filled. For quick work use aniline spirit stain made with Nigrosine black. Two coats may be given within one hour. This quick process is used by picture frame makers.

Thin up some japan black with turpentine and add a little coach varnish to bind the stain. Dissolve four ounces of Seal Brown aniline in a gallon of boiling water, and when this is cold add four ounces of strong vinegar. In order to secure the necessary deep black effect several coats of stain are required. A very black effect may also be had with four ounces of Nigrosine dissolved in one gallon of boiling water, or in one-half pint of vinegar.

Light and Dark Oak.— For a light oak stain, take two pounds of raw Italian sienna and one-half pound of raw Turkey umber, both ground in oil, and thin up with half gallon each of boiled oil and turpentine and one quart of brown japan. A dark oak may be made from burnt umber alone, or with raw umber, or with some raw sienna added, according to depth of color desired. The umber darkens, the sienna lightens color.

Golden Oak.— Equal parts of gold size japan and the best asphaltum varnish make one of the best golden oak stains; thin up with turpentine. This stain dries quickly and hard, and will not raise the grain of the wood. Wipe off soon after application of stain. Although asphaltum gives the best of golden oaks, yet it is not the best thing under varnish, causing much trouble.

A spirit stain may be made by steeping an ounce of powdered nutgalls in a pint of alcohol, which let stand well corked for two or three days. Then strain it. It should then be decidedly black. Now dissolve a half-ounce of Bismarck brown in one-half pint of alcohol, strain, and add to the first solution; then add a teaspoonful of tin chloride and enough alcohol to make the whole amount one quart. Should the Bismarck brown make the color too red, use a solution of saffron in alcohol instead.

A water stain golden oak may be made with a pound of burnt umber and one-half pound of raw sienna, both in powder form. Mix with one gallon of water, and then add a gill of strong ammonia water, say 28 deg.

Antwerp Oak.— Dissolve Nigrosine black in water and add a little Bismarck brown. The flakes of the oak should show up coffee-color or brown, with the grain black.

Gray Oak.— The wood should not be filled for gray oak effect, but it should be shellaced and waxed for finish.

To give the desired gray color to the wood, take a slate-gray aniline and dissolve in water to the desired shade. There is on the market a "silver gray" stain, in water. This is finished with white shellac and waxed.

A very nice bluish-gray stain may be obtained by the use of a solution of iron sulphate, the color result depending upon the strength of solution and amount of tannin in the wood.

Dark Oak Stains.— Oak may be darkened with a strong decoction of coffee; this gives a very pleasing brown.

To equal parts of water and sulphuric acid add iron filings enough to make a very dark liquid. Several coats may be necessary.

Boil eight ounces of madder and two ounces of logwood chips in a gallon of boiling water; apply hot. When dry, apply a solution of pearlash, two drams to a quart of water.

Boil eight ounces of logwood chips in a pint of water, and add one-half ounce of tartaric acid. Apply hot.

Boil eight ounces of madder and same of fustic in one gallon of water, and apply hot.

A strong solution of sal soda will darken oak, but it will require several coats, two at least. Sandpaper very lightly, and rub to finish with boiled oil.

Give the wood a coat of strong ammonia water, and when dry give it a coat of turpentine. The finish may be varnish, shellac, or wax, as desired. Bichromate of potash solution will give a richer effect than ammonia.

A very nice effect may be obtained by the application of a paste of freshly slaked lime, which when dry may be brushed off, following with a coat of boiled oil, rubbed.

Antique Oak.— This may be done in various ways, but here is a common method: Dissolve twelve ounces of dry Vandyke brown in one gallon of water, to which add a pint of ammonia water of 16 or 18 deg. Heat stain on stove, then add, after removing from stove, one-half pint of turpentine, which will prevent raising of grain of wood.

Various Stains For Various Woods.

Brown Stains.— Various brown tones may be obtained by mordanting with bichromate of potash and the application of a decoction of fustic or logwood.

Diluted sulphuric acid, applied to a clean surface, will give a brown stain that will vary with degree of strength of the solution. When the acid has browned the wood sufficiently its action may be arrested by the application of ammonia. Apply the acid with a bristle brush.

Tincture of iodine gives a fine brown on wood, but the color is not permanent unless protected by a coat of varnish.

A simple brown stain may be made from half-ounce of alkanet root, one ounce of aloes, and one ounce of dragon's blood, placed in alcohol to digest, using one pint of the alcohol. The wood must be prepared for the stain by mordanting it with an acid. Like all alcoholic stains, this one is not very durable.

Bismarck brown one part, sulphate of soda eighteen parts, Nigrosine one-fourth part. Or you may omit the Nigrosine. Dissolve all in water to the required strength.

Or you may try Benzo brown three parts and table salt ten parts.

For a good cheap stain, especially for floors, dissolve one-fourth ounce of permanganate of potash in one quart of hot water and apply hot and freely. This stain is at first a bright magenta red, but soon changes to brown. The application of two or more coats will give a darker shade of brown. When dry rub with boiled oil or with wax.

Dissolve a pound of dry Vandyke brown in one gallon of water, which must be hot, and boil it until the volume is reduced to two-thirds. Then mix up two ounces of potash with water enough to dissolve it, then mix with the stain. Apply two or more coats, as to color desired.

A yellowish-brown may be obtained with iron sulphate.

Boil one part of catechu (cutch or gambier) with thirty parts of water, then add a little bicarbonate of soda. Apply the stain, and when dry apply a solution of one part bichromate of soda in thirty parts of water. By a little difference in the method of treatment, and by varying the strength of the solution, this will give various shades of brown. The stain is permanent and tends to preserve the wood.

Black Stains.— The following stain may be applied to almost any kind of wood and successfully. Boil one ounce of logwood extract in 3¼ pints of water, and when the dye has been entirely boiled out of the extract take the liquid and add to it a dram of yellow chromate of potash (not bichromate), then shake the mixture. At first the color will be purple, but it quickly turns to black. This stain makes a fair writing ink also.

Brazilwood one part, to five parts of water; boil with fifteen per cent. of alum. For a very deep black use a mordant of solution of iron, then apply the stain.

Nigrosine black, four ounces, dissolved in one gallon

of boiling water. A denser solution than this will give a jet black.

Apply a coat of hot logwood solution and when dry apply another coat. When this is dry give it a solution of iron acetate, which will act on the logwood stain and produce a good black. For a finish it may be left as it is, a dead black, or it may be waxed or rubbed with raw oil.

Boil together Brazilwood and powdered nutgalls in soft water until the liquid becomes black. Filter and apply hot. As many coats should be given as will be necessary to produce a black surface; follow with a coat of iron acetate solution. If this is supplemented with a coat of alum and nitric acid solution, with a little verdigris also, the durability of the stain will be increased. Finally apply a decoction of nutgalls and logwood.

Break up an ounce of nutgalls and pour over same half-pint of strong vinegar; let it stand thirty minutes, then add an ounce of iron filings; the vinegar will then begin to effervesce. Cover it up, but not so as to exclude all air. Let it stand thirty minutes, then it is ready for use. Give the wood a coat of the stain, and let it dry. Apply as many coats as may be needed to get the desired depth of color. Keep in tightly corked bottle.

Black Stains for New Furniture.— There are many ways for producing black on wood, but probably sulphide of soda or potash, in the lump, is the best chemical substance for the purpose. It makes a fast black, one that is superior to that produced with acetate of iron or tannic acid. The first application must be allowed time to dry, about two days, before giving the second coat. The resultant stain is a perfect jet black.

Boil one pound of logwood chips in two quarts of water for one hour. Apply while hot, and when dry repeat the application. Dissolve an ounce of copperas in a quart of water, or stronger if desired, and apply; this will give

an intense black, exposure to the air developing the color. For the finish, make a size with dry lampblack and glue, very thin, and apply. When dry sandpaper with fine paper. Then apply a coat of shellac containing enough drop black to darken it, thinning with alcohol. Or, add drop black to good copal varnish and give two coats; the finish may be either dull or gloss.

Black or Ebony Stains.— For a hard wood, give two coats of Nigrosine black stain and fill with black filler; sandpaper smooth with fine paper, then apply a coat of ivory japan black, thinned with turpentine; when dry, varnish and polish.

Take two pounds of logwood chips, one-half pound of copperas, four ounces of dry drop black, one pound of logwood extract, and boil in two quarts of water for four hours; strain, then add an ounce of nutgalls, powdered.

Dissolve 300 parts of Campeachy extract in 2000 parts of boiling water, then add fifty parts of eighty per cent. acetic acid, followed by 400 parts of iron acetate and water enough to make the weight up to 3000 parts; the whole being finally allowed to cool.

Nutgalls 14 ounces, ground logwood 3½ ounces, iron sulphate 1¾ ounces, and verdigris 1¾ ounces. Apply one coat, let it dry, then apply iron acetate solution, two or three coats of it.

Red Ebony may be imitated on sycamore or beech, the former being the best. Mordant with a hot alum solution, and when this is dry apply a hot solution of brazilwood. When this in turn has dried apply a cold solution of copper acetate.

Lignum Vitæ may be imitated on sycamore or beech by applying a hot decoction of madder, let it dry, then apply a wash of sulphuric acid, washing off with clear water as soon as the required depth of color is obtained.

Best Woods for Ebonizing are those having a very close grain and which are very dense or hard. Pear wood

is considered by some to be the best, but apple, sycamore and hazelwood also are very good.

Common Black Staining.— Boil together brazilwood, powdered nutgalls, and alum in soft water until the water turns black; filter, and apply warm. Repeat until the color is deep enough, then apply a coat of solution of iron acetate.

Polish for Ebony Wood.— To white shellac varnish add a small quantity of finely powdered Prussian blue, which will greatly enhance the ebony effect.

Walnut Stains.— Mix equal parts of raw umber and Vandyke brown to a paste with ammonia water, and reduce to staining consistency with water.

Make up a mordant of permanganate of potash one ounce in a quart of water, apply, and when dry apply a coat of a solution of one ounce of powdered nutgalls, or crushed nutgalls, mixed with four ounces of potash, adding some Vandyke brown for color, making of the formula one quart of stain.

Mix together half-gallon boiled oil, one quart of best brown japan, and half-gallon of turpentine, and add for color two pounds of burnt umber, in oil. By the addition of a half-pound of either drop black or Vandyke brown a deeper color may be had. A lighter walnut color may be obtained by adding one-half pound of burnt sienna to the first formula.

A light walnut stain may be made from an ounce of permanganate of potash dissolved in thirty ounces of pure soft water, applying two coats with five minute intervals between; wash off with clear water, and when dry oil and polish. A dark walnut may be had by following the foregoing formula and after washing with clear water make dark veins in the wood, with iron acetate solution, using a soft hair pencil.

A cheap walnut stain may be made by dissolving dry burnt umber in a little vinegar; then mix a pound of

dry Venetian red with a pint of asphaltum and a quart of turpentine, adding this to the vinegar preparation.

White pine or any white wood will take walnut stain well. Permanganate of potash gives a good walnut on white wood, and the walnut markings may be imitated with a soft hair pencil and an iron solution. Standage says that privet berries, two ounces in one-half pint of water, will give a walnut color that is difficult to tell from the real wood. Burnt umber is a good walnut color, and it may be lightened with burnt sienna, or darkened with drop black. Vandyke brown, the equivalent of burnt umber and drop black mixed, gives a good black walnut color. Such pigments are very handy for making stains, and they may be mixed with either water or oil.

To a gallon of shellac add a pound of dry burnt umber, a pound of burnt sienna, dry, and a quarter-pound of dry lampblack. First mix the pigments by sifting, then mix with very thin shellac. Apply one coat, and when dry sandpaper lightly, after which finish with a coat of shellac or copal varnish. Useful especially for the backboards of mirrors, etc.

Cherry Stain.— Bismarck brown makes a fine cherry stain, one ounce in two quarts of water, boiling, adding one-half gill of vinegar. If too dark it may be thinned down with water.

A cheap stain may be made from a pound of burnt sienna and a pint of strong vinegar; apply liberally, and wipe off soon as done.

Mix two pounds of burnt sienna and one pound of raw sienna, both ground in oil, with two quarts of boiled oil, one quart of the best brown japan, and the same of turpentine. The color of burnt sienna varies, from a cherry red to a decidedly brownish red, hence if you get the latter kind then omit the raw sienna and use two pounds of the burnt sienna. In all cases of staining where burnt or raw sienna is mentioned it is understood

that the best, or Italian sienna, is to be used. The same with umber, only Turkey umber is good enough for staining with.

Dragon's blood makes a good cherry stain, two ounces to the quart of alcohol, shaking occasionally until perfectly digested.

Boil four ounces of annota in three quarts of soft water, preferably in a copper kettle; add a lump of potash about the size of a hulled walnut. Keep the kettle on the fire thirty minutes after adding the potash, and be sure that the annota is perfectly digested before you add the potash.

Equal parts of alkanet root, aloes and dragon's blood and steep in alcohol that will equal in weight twenty times the combined weight of the colors, using ninety-five per cent. strength alcohol. Let the decoction stand several days in tightly corked bottles. Prepare surface of wood with a mordant of dilute nitric acid (eight to ten per cent.), which will give a rather dark effect, but the stain may be lightened by diluting it with alcohol. Strain before using.

Red Stains.— Carmine 30 parts, ammonia 50 parts, salicylic acid 3 parts, and distilled water from 1000 to 2000 parts. Rub the carmine down in a porcelain mortar, and stir up with a little water. Meanwhile the salicylic acid has been dissolved in the ammonia, this solution being added by degrees to the carmine, which it dissolves. Finally the rest of the water is added by degrees.

Eosine aniline red one part, sulphate of soda ten parts, acetic acid three parts, with water to make to desired strength.

Magenta No. 2, B, 1½ parts, auramine 1 part, soda sulphate 10 parts; water to desired strength.

Azo cochineal 2 parts, soda sulphate 10 parts, sulphuric acid 2 parts. Water sufficient.

Rose benzol five parts, water ten parts.

For the above aniline dyes it is advised to use a mordant, alum water being the one to apply to the wood.

Blue Stains.— Victoria blue 42 one part, soda sulphate ten parts. Or Nile blue one part, soda sulphate ten parts. Or soluble blue, R, three parts, water eight parts.

One coat of aniline blue for ultramarine blue. To get a fine plum or damson blue apply a coat of dragon's blood over the blue stain.

Boil 1 pound of indigo, 2 pounds of woad, and 3 ounces of alum in one gallon of water, and coat the work until well stained.

There are many ways for obtaining beautiful blue effects with stains on wood, mostly with the aniline dyes. A very pretty blue is obtained with bleu de Lyon, the blue having a reddish cast; bleu de lumiere, a pure blue; and light blue, which has a slightly greenish cast. These anilines may be dissolved at the rate of one part of color to thirty parts of ninety per cent. alcohol; apply to the wood in the usual manner. Another very fine blue may be had by dissolving a little more than one ounce of the best indigo carmine in 8¾ ounces of water. Give the wood several coats, allowing each coat to dry before applying another. A very simple and inexpensive blue stain may also be had by applying a coat of Prussian blue dissolved in water, repeating the application for greater depth of color. When dry size with warm, not hot, glue size. Sandpaper lightly when dry, using very fine paper, then finish with a coat of varnish, or French polishing.

Green Stains.— Treat a solution of indigo carmine with sufficient picric acid, in solution, to produce the desired shade.

Brilliant green three parts, Bismarck brown half part, soda sulphate ten parts. Or Brilliant green one part, Chrisoidine one and one-half parts, and soda sulphate ten parts. Or Malachite green one part, Nile blue, A, ¼ part, soda sulphate ten parts. All in water, q. s.

Emerald green may be obtained with a coat of Victoria green. A deep olive green may be obtained with a coat of yellow or orange stain on the Victoria green.

A handsome bluish-green may be obtained by treating the wood with prussiate of potash solution, after which apply a solution of iron acetate. This makes a sort of peacock blue.

The once popular malachite green stain used on furniture and house trim is made from Prussian blue and raw sienna, in such proportions as will give the desired color.

Green Stain on Oak.— Mix up some bronze green paint in oil and thin out with turpentine to a thin paint; apply it with a woolen cloth, not a brush, and rub off well.

Or add 4 ounces of verdigris to 3 pints of strong vinegar: first pulverize the verdigris. Add ½ ounce of sap green and the same of indigo; add also some brown stain made from walnut hulls boiled in water. Apply hot with a brush.

Yellow Stains.— Yellow stains vary greatly in composition, and most are somewhat fugitive. A fairly stable one consists of half as much barberry wood as water, by weight, adding a little alum to the extract.

Treat surface of wood with a hot concentrated solution of picric acid, let it dry, then stain it. Picric acid being very poisonous care must be taken in its use.

Boil a pound of Persian berries and two ounces of pearlash in a gallon of water; add gradually a strong solution of alum: When precipitated pour off the water.

For an orange yellow apply a coat of nitric acid, ½ part mixed with 1½ parts of rain or other soft water. The undiluted acid will give a brownish-yellow.

Yellows may be made from Auramine four parts, sulphate of soda ten parts. Or Naphthol yellow one part, soda sulphate ten parts, sulphuric acid two parts. Or Crocein orange one part, soda sulphate ten parts, sulphuric acid one part. Water q. s.

Gray Stain.— Add one part of silver nitrate to 50 parts water, distilled preferred. Apply, and when dry acetate of iron solution, one or more coats, as necessary. Be careful not to get any of this stain on your hands.

Gray stain for oak may be made with iron acetate, the solution acting on the tannin in the wood, producing a fine gray effect. To secure a handsome rich brown apply a coat of orange shellac over the gray stain.

For maple a silver-gray stain may be made from iron acetate, or from a solution of gallnuts. Or verdigris in vinegar, or crystallized verdigris in water. In any case, the solution may be used warm or cold.

Rosewood Stain.— To one gallon of alcohol add two ounces of camwood; set it in a warm place twenty-four hours, then add three ounces of logwood and one ounce of nitric acid, and when all is dissolved the fluid may be strained and used.

Apply a coat of aniline blue, over which apply a coat of crimson, orange, or yellow stain.

To one pound of rose pink add a pint of good asphaltum varnish, one pint of best brown japan, one pint of boiled oil, and one quart of turpentine. Add more rose pink if color is too dark; if too light add more asphaltum and turpentine.

Dissolve two ounces of Eosine, G, aniline and one ounce of Nigrosine in two quarts of boiling water; when cold add half pint of vinegar.

CHAPTER III

PIANO FINISHING

IN the making of a piano the case enclosing the strings, hammers, etc., is the principal part of the whole work. The case is glued together, not nailed or screwed, and the outside is varnished. Of varnish the case will take over a gallon; of glue to fasten the structure together it will require thirty pounds. Of the time occupied in the making of the instrument nearly one-half goes into the gluing and varnishing of the case, and this includes, of course, the time required for the drying of the glue and the varnish. Nearly three months are given to the varnishing and finishing processes alone. The wood must be made perfectly smooth and level, and it must be well filled. The highest grade of materials is used. The wood employed may be oak, walnut, mahogany, or what not; it may be veneered, or stained black, but in all cases, excepting as to the stains, the treatment is the same. The vegetable stains are used, as the anilines will not do at all. Two coats of stain are used. After staining, two coats of paste filler are given, these being rubbed off in the usual manner, but are always given forty-eight hours for drying before sandpapering. The paste filler is always stained. The filling is sandpapered smooth. Sometimes, maybe in most cases, one coat of paste filling answers; of this the workman must be the judge. Then the rubbing varnish is applied. This varnish must be fine-grade, not too heavy of body, and should be applied when the temperature of the room is not below seventy deg., Fahr. From five to seven coats of this varnish are

given, with a week between each for drying, each coat being rubbed down with fine sandpaper. The last coat of rubbing varnish is rubbed down with fine pulverized pumicestone and water, using a felt pad for rubbing with. To make sure that the pumicestone powder contains no grit it is passed through a fine sieve of hair cloth. Only the imported pumicestone should be used, as the American grade is too gritty. Follow the rubbing with a washing off with plenty of clean water, washing out every particle of pumice, then wipe dry with a clean wet chamois.

And now the job is ready for the polishing varnish, which is flowed on freely and brushed out level. The use of a very soft hair brush is necessary for this part of the varnishing. After the job has stood for a week it is rubbed with pulverized rottenstone and water, using the palm of the hand as a rubber, continuing this until the desired polish appears. Then it is washed off with clear water, dried with the chamois, and rubbed with a few drops of sweet oil on the palm of the hand. The oil is then spirited off, by means of a clean cloth made slightly moist with grain alcohol. As alcohol will quickly attack varnish it requires deft work to avoid any injury when spiriting off. Some finishers use cornstarch in place of alcohol for removing the oil, but it does not give as clean a surface as the alcohol does, though its use is safest in the hands of one not expert in spiriting off. Follow with a clean cotton rag.

While a week is indicated as being the time for the drying of a varnish coat, yet not infrequently as many as ten days are given, and there is no doubt that two weeks would be still better. This because of the number of coats of varnish applied, the undercoats requiring extra time owing to the fact that most of them are sealed against the air by the upper coats. Many of the worst troubles in the finishing room, as regards varnish, come from the want of perfect drying of the coats. The

varnish must be right, too, or other trouble may ensue. For some purposes kauri gum is excellent, but for piano work only Zanzibar gum should be used in the finishing varnish; it is the hardest gum used in piano varnishes. Even when carrying the same amount of oil as a kauri gum varnish it will give a much harder surface, and hence it polishes best. Moreover, the finishing varnish will have to bear the brunt of wear, hence should be a good, hard varnish. For the best results the finisher must use a quick-drying, non-elastic varnish for all the coats but the finishing, which must be very elastic. Such a procedure will, we believe, prevent any trouble:

Finishing an Antique Oak Case.— To finish a dark oak piano case, apply a suitable water stain. Next day sandpaper smooth, and fill with paste filler. Rub the filler well into the wood with a leather pad. Let it stand until the twelfth day, then apply a coat of orange shellac. Next day sandpaper, then apply a coat of piano rubbing varnish. On the twenty-third day apply a coat of piano rubbing varnish. On the thirty-first day give it another coat of piano rubbing varnish. On the thirty-ninth day still another coat of piano rubbing varnish. On the forty-seventh day, another coat of rubbing. On the sixty-first day, scour with pulverized pumicestone and water. On the seventy-fifth day flow on a coat of piano polishing varnish. On the eighty-ninth day rub lightly with flour pumicestone and water. On the ninety-first day rub to a surface with pulverized rottenstone and water. On the day following this dry-polish with the palm of the hand, using powdered rottenstone. On the next day, oil off and clear up with alcohol.

Another Piano Finishing Process.— While the piano case is in the cabinet shop sponge it well with clear, cold water; let it dry, then sandpaper it carefully. Next, apply the paste filler, and rub the filler well into the wood with the pad. Let stand three days, then sandpaper, No. o

paper; then apply a primer coat. On the seventh day sandpaper lightly with No. ooo paper, making the surface of the work perfectly smooth. Then apply a coat of kauri piano rubbing varnish. On the twenty-first day sandpaper as before, and give it another coat of the rubbing varnish. On the thirtieth day rub with No. 1 powdered pumicestone and water to a surface. On the thirty-fourth day apply a coat of elastic Zanzibar piano polishing varnish. On the forty-sixth day rub lightly with No. o pumicestone and water. On the fiftieth day flow on a coat of Zanzibar polishing varnish. Sixtieth day, rub with powdered pumicestone and water. Sixty-third day, rub with rottenstone and water. Sixty-fourth day, dry-hand polish with refined velvet lamp-black; follow with washing off with clear water.

Finishing Rosewood Case.— The process given for finishing antique oak cases may, with the exception of the stain, be used in the finishing of rosewood cases, whether light or dark rosewood. To do a dark rosewood case apply a coat of alcohol red stain, then sandpaper smooth and fill as directed for rosewood. Following the filling comes the coat of orange shellac, which is to be glazed over with a coat of asphaltum varnish; after this point you may proceed as directed for dark oak case, beginning with process of the thirteenth day. Which see.

Mechanical Varnishing.— Modern factories that are strictly up-to-date use a varnishing machine, composed of a rack on which several parts of a frame are placed on end, side by side. Each rack holding the parts of six pianos, the frame is placed in the machine, which slowly immerses it in a vat of varnish, where it is allowed to remain for a brief period, when it is slowly drawn out. This drawing from the varnish vat is done so slowly that the motion is hardly perceptible to the eye, and it is so done that the surplus varnish flows away without streaking, coming out uniformly smooth and level. The method

saves time, which represents money, and makes each part damp-proof, which is especially important in the shipping and exporting of these goods. The varnish preserves each glued part from the action of moisture.

How to Prevent Cracking of Varnish.— Some piano makers refuse to ship their instruments in cold weather. One New England firm, making a medium grade of goods, but which are well finished, state that they use only air-dried lumber, making solid cases, and use no shellac. They body-up with a quick varnish, and polish on a slow varnish. During the two years they have been doing this they have not had one instance of varnish-cracking. To avoid the trouble the undercoats must be quick-drying, non-elastic, and with an elastic finishing coat. They give less time to the drying of the under coats than to the finishing coat. This latter should have time enough to become quite hard, essential to good polishing. If, however, insufficient time is allowed for each coat to dry there will be varnish-checking. It might be supposed that one or two weeks would suffice for drying varnish, yet to get it positively dry within that time it would be necessary to oven-dry it, as was tried unsuccessfully by one manufacturer — the heat destroyed the glue.

Trouble With Shellac Finish.— A piano finisher wrote me in relation to trouble he was having with his finishing. Frenchpolish surfaces, on which white shellac had been used, showed up milky or gray. He said: "We very often have this to occur shortly after the work has been rubbed, while again it will not show until several weeks after the rubbing. In nearly every case the work looked clear before rubbing, and even after the rubbing, and we have tried many ways to overcome this fault, but with very little satisfaction." This trouble is probably due to water in the white shellac. There has for years been trouble in finishing pianos with shellac varnish, and it will continue as long as shellac is used as a rubbed

finish. Piano makers have for years been trying to find a remedy, but without success. It is an unsightly exudation, and once was supposed to come from the oil used in the polishing, but it is now attributed to the vegetable wax which exists in the shellac. This wax is found to run from six to seven per cent., by weight, and it may be removed. First let us explain how the wax affects the finish. It combines with the oil used in the polishing and with it forms a soft, greasy compound that prevents the polish from hardening properly. It also causes the finish to be very sensitive to changes of temperature, and to be susceptible to injury from wear or use. This greasy matter exudes from the polish after a time, causing the trouble the piano maker complains of. It is a sort of efflorescence, which greatly impairs the beauty of the finish. There is a process whereby the fatty matter may be separated from the lac by agitating a strong solution of alcohol shellac with fresh stick lac or seed lac, or filtering on this lac. Thereby the readily soluble resin, as well as slight quantities of coloring matter contained in the fresh lac are abstracted from it, while the more slightly soluble vegetable wax is separated from the solution. By one or more treatments of the concentrated solution of shellac with fresh seed lac a clear alcoholic solution free from wax of the shellac resins is obtained, which is not practicable by simultaneously dissolving the shellac and seed lac in a sufficient quantity of alcohol.

Such a shellac resin solution freed from vegetable wax has heretofore not been employed as a furniture polish, neither would it be satisfactory for the purpose as it is too " short " and lacks in pliancy, rendering it unsuitable for being readily and uniformly rubbed into the wood. So far it would seem to indicate that we are no nearer the end of the trouble than we were at the beginning. But the chemist comes to the rescue again and tells us how the difficulty may be overcome. To the shellac solution

separated from the vegetable wax, a medium is added which fully takes the place of the wax as regards pliancy and polishing qualities, without exhibiting its undesirable after-effects. Such a medium has been found in the essential oils, especially in oil of rosemary.

The production of the new polish is, for instance, as follows: Dissolve 20 kilos of shellac and 4 kilos of gum benzoin in as little 95 or 96 per cent. spirit as possible, with the addition of 1 kilo of oil of rosemary. The concentrated solution is now repeatedly filtered over fresh stick-lac until the vegetable wax contained in the solution is completely abstracted and the solution has become perfectly clear.

Another chemist describes the manner in which this fatty wax may be removed as follows. Add some 62 deg. benzine to the alcoholic solution of shellac, agitate well, then allow it to settle; now draw off the strata of benzine in which the wax has dissolved, and so obtain the shellac solution clear and free of the objectionable wax.

CHAPTER IV

FRENCH POLISHING

FRENCH polishing consists in the repeated rubbing into the wood of shellac, using a rubber or pad that is slightly coated with raw linseed oil, which makes the rubbing easier. A modern method calls for the filling of the wood with a filler, followed by the shellac polishing. As shellac is affected both by cold and dampness the work requires a temperature of not much less than 70 deg. Various formulas are used, each adapted to some particular kind of wood, but all are based on the principle of rubbing shellac into the wood until it is filled and the surface made smooth and with a soft polish. It is a very beautiful and durable form of wood finish. Orange shellac is used, and to this any desired coloring may be added.

The rubber used is made from a strip of woolen cloth, an inch in width, and which is rolled up like tape. Over this is drawn a piece of clean, soft muslin, the edges being drawn up on one side of the rubber and tied, thus forming a handle to hold while using the pad or rubber. This rubber is intended for rubbing flat surfaces. For irregular surfaces make a rubber with some raw cotton, tied in a muslin, with a handle like the one for the flat rubber. The rubbers must be perfectly smooth on the rubbing surface, having neither wrinkle nor crease.

Wood that is not perfectly straight-grained, clear, and solid should first be sized with thin glue size, and when this is dry lightly sandpaper it smooth. The filler used, in the modern method alluded to, is plaster of Paris mixed

with water, and coloring if desired. There are fillers used, but most expert finishers prefer the plaster. Be careful not to over-fill with the plaster, removing all surplus from the surface, and thus saving a great deal of sandpapering.

Being ready to polish, remove the outer wrapping of the rubber, and apply a few drops of shellac on the face of the rubber, whether cotton wool or woolen cloth; be careful not to get too much on, the idea being to have just enough shellac on so that if lightly pressed the shellac will exude. If too much shellac comes out on to the surface of the work it will cause a ridgey effect, spoiling the work. Hence it will be seen that the process requires great care and skill.

Having applied the few drops of shellac to the inner rubber, replace the outer covering, tie the same, to form the little handle, and apply a few drops of raw linseed oil to the face of the same, the oil making the rubbing easier and smoother. Begin rubbing at a certain part of the work and rub evenly and with light pressure, working in a circular manner until, gradually, you reach the opposite part of the work. Occasionally apply a drop or two of oil to the rubber. Once you start rubbing keep the rubber in motion until you reach the end of the work. And even then you must not stop abruptly, but gently slide the rubber off the work, and so leave no ridge or other mark, to remove which would involve considerable time and labor. This is very important. And do not allow your rubber to become dry as you rub, but remove the cover and apply a little shellac to the inner pad. After you have rubbed in several coats, and a soft luster begins to appear, a dry rubber will do no harm. In fact, the dry rubber is used then by preference. Each time that you apply shellac to the pad squeeze a little of it out in the palm of the hand, working the pad a little in it, and so equalizing the shellac in the pad. If the muslin

covering should become shiny, shift it and use a fresh part of the muslin.

In case you should be unfortunate enough to have rubber marks to appear on the surface of your work, remove them by rubbing with the wet rubber, but beginning at the point where you left off at and working in the reverse direction. It is best to use in any case long strokes, rather than short, jergy strokes. Some rub lengthwise of the work, then in a circular manner. Do not place too much pressure on the rubber, nor rub too long in one place. Place the shellac in a saucer, if you wish, though a bottle is better. In rubbing out rubber marks use a half-dry rubber, and bear on with somewhat greater pressure than when rubbing at first.

If you have a large surface to polish, say a table top, polish but one-half the surface at a time. Leaves or boards of tables may be done one at a time. After rubbing in the whole surface, with the circular motion, go all over it again, this time rubbing straight with the grain of the wood. Rub a few times only, this in order to remove the temporary rubber marks of the first rubbing. In the beginning rub with a very light pressure, but increasing the pressure as the rubber becomes drier. When the polish looks rough or scratched it must be treated by gentle rubbing with very fine sandpaper, but be sure the polish is quite hard before you do this. Do not try to remove roughness by hard rubbing nor by rubbing repeatedly in the one place. Rubbing too much in one place will result in the softening of the whole body of the polish, causing it to either rub up or rub into ridges. If there is too much shellac on the rubber the alcohol in it will mar the polish. If your room is too cold or damp, the effect will be a milky surface, to remedy which take the work near a fire and let the heat act upon it until the milky effect disappears.

Apply but one coat of polish a day, but rub in coats

enough to form at last a film of shellac on the surface of the work, which will show that the pores of the wood have been filled. If then the work shows a uniformly even surface it may be "spirited off." This is done with alcohol and the rubber that the polishing was done with. Some finishers use clear alcohol from the start, while others prefer to add alcohol to shellac, reducing the amount of shellac until there is only the clear alcohol on the rubber. This operation requires much care, as the alcohol easily injures the polish. Pass the rubber, dampened with alcohol, lightly and quickly over the polished surface of the work, being careful not to use too much alcohol, and to use it sparingly and with constant care. This spiriting off removes the oil left on the polish, and which if not removed would mar the surface by dimness or cloudiness. After the spiriting-off the polish will appear bright and beautiful — or ought to, and will if the work has been done properly.

In spiriting-off use a new pad, a rubber made from three or four folds of clean muslin over a pad of raw cotton; cheesecloth is preferred by some. These coverings may be removed, one by one, as they become dry, the inner pad holding the alcohol. Rub with a circular movement. Some finishers think that the alcohol is made the better for the spiriting-off process by allowing it to stand open to the air for an hour or two. It is also thought that allowing the polished work to stand two or more hours before spiriting-off will give a better or clearer polish. As to the alcohol being exposed, the result would be that it would absorb a certain amount of water from the air, weakening it to that extent; the same result would follow by adding some water to it, and water would be a very undesirable liquid to apply at that stage of the work. Perhaps the alcohol by exposure loses some of its volatile spirit, and in that way becomes less dangerous to the polish. At any rate, all such matters must be left for the

experimenter. Although we must not despise the many little ideas that workmen have about their work, for many improvements in methods have come just that way, by experiments and accidents.

An inexpensive method of French polishing black work may be described in this connection: Japan drop black is beaten up to a paste and to a half-pint a tablespoonful of rubbing varnish is added and well mixed with it; the mass is then thinned with turpentine or benzine. Several coats of the black are applied to the wood, making each coat smooth, and when all is dry enough a coat of good furniture varnish is applied, and this rubbed to a polish with rottenstone and sweet oil.

While orange shellac is mostly used in French polishing, yet for light woods it is found necessary to use white or bleached shellac, which may be colored if color is desired. A very pale shellac, called lemon, may be used for certain kinds of wood or finish.

To save spiriting-off some finishers apply a glaze to the finish, which forces a gloss or polish, rendering the removal of the oil unnecessary. This glaze is made from gum benzoin dissolved in alcohol; exposing the alcohol for a time to the air is thought to improve it.

While shellac is the substance used in "bodying up" for French polishing, yet there are others that also may be used, or used in connection with shellac. Thus, 1½ oz. shellac and ¼ oz. sandarach, dissolved in ½ pint of alcohol. Such gums as mastic and tragacanth also may be used.

So also the spiriting-off may be done with other than clear alcohol, as has already been described. Thus, in ½ pint of ninety per cent. alcohol place two drams of shellac and the same quantity of benzoin; place in a bottle, which shake occasionally. Stopper tight. When the gums have dissolved add two teaspoonfuls of clear

white poppyseed oil, shake well, and the mixture is ready for use. This is a form of glaze, previously mentioned.

VARIOUS POLISH FORMULÆ.

Polish for Turners' Work.— Shred an ounce of pure beeswax and mix with turpentine, just enough to make a stiff paste. Dissolve an ounce of sandarach in one-half pint of alcohol. Add the latter very gradually to the wax. Use a soft woolen rag and apply the polish to the object as it turns in the lathe. The polishing is done with a piece of soft old linen. A very high degree of polish may be obtained by this method.

Polish to Stand Water.— Place in a stoppered bottle a pint of grain alcohol, 2 oz. gum benzoin, ¼ oz. gum sandarach, and ¼ oz. gum animé. Dissolve by placing bottle in hot water, or in a sand bath. Then add about ¼ gill of the best clear poppy oil, shake well, then put away for use.

Ebony Polish.— Add ¼ oz. best dry ivory drop black to about ½ gill of shellac varnish. Use a drop or two of the black polish on the inside pad of the rubber. In this case use two muslin covers over the pad.

Polish for Fine Cabinet Work.— Mix together and shake well, 4 oz. each of alcohol, vinegar, and turpentine, 16 oz. of raw linseed oil and 1 oz. of butter of antimony.

Polish for Dark Woodwork.— Pulverize fine a dram of gum elemi and ½ oz. shellac; dissolve in a mixture of 2½ oz. 90 per cent. alcohol and a dram of almond oil; place in bottle and when all is dissolved it is ready for use.

Or, orange shellac 2 oz., alcohol ½ pint, and benzoin 2 drams. Mix, keep in stoppered bottle, and keep in a warm place for a week, shaking occasionally to prevent settling. To use, first oil the wood with raw linseed oil, rubbing it well into the wood, after which wipe dry with a clean

muslin rag, then rub to a polish in the usual Frenchpolishing manner.

Polish for Carved Work.— In a pint of 90 per cent. alcohol dissolve 2 oz. each of seed lac and white rosin. Carved parts and pillars of cabinet work must first be coated with copal varnish, which is then made smooth with fine sandpaper; then the polish may be applied. Use a bristle brush in applying the polish to carved parts and standards. Better results follow if the polish and object to be polished are both warm, but the polish should be warm at any rate.

Polishing Walnut.— Black walnut is to be made smooth and clean, and the polish is to be applied to the bare wood, the finish giving all the appearance of a rich old walnut. First apply a very thin coat of brown shellac, and at once rub with a piece of smooth fine pumicestone until dry. Then apply another coat of shellac, and rub as before. Then it will be ready for the polish, which is prepared as follows: Mix together raw oil and turpentine, equal parts, and beeswax to form a paste. Apply by means of the usual rubber. If the surface of the wood is not smooth enough after the rubbing with shellac and pumicestone, rub it with fine sandpaper until it is smooth, then rub with polish again.

Varnish Polish.— Boiled oil 1 pint, turpentine 1 pint, vinegar ¾ pint, grain alcohol ½ pint, and butter of antimony ½ oz. Place in bottle and shake well.

Polish for Hardwood.— Crude petroleum oil is very good, but the addition of a gill of alcohol to the quart of crude oil will improve it. Excellent for cleaning up new but dirty furniture, pews, etc., after removal from factory to place of using.

Polish for Papier-Mâché.— The polish advised for fine cabinet work may be used on papier-mâché; apply it with a woolen rubber, using gentle pressure until the desired polish appears.

White Polish for Light Woods.— Dissolve 6 oz. white shellac in a quart of alcohol, and add 2 oz. white gum benzoin and 1 oz. gum sandarach.

Useful Polish for Dark Furniture.— To a pint of raw linseed oil add an ounce each of rose pink and alkanet root, beaten up in a metal mortar. Allow the mixture to stand two days, then pour off the oil, which will form a rich liquid polish.

Piano Polishes.— Raw linseed oil 32 oz., solution of antimony chloride 2 oz., and 8 oz. each of dilute acetic acid, turpentine, and alcohol.

Raw linseed oil 40 oz., alcohol 4 oz., dilute acetic acid 16 oz., solution of ammonium chloride 2 oz., spirits of camphor 1 oz. Add first to the oil the antimony solution, then the camphor and acid, and finally add the ammonium chloride to the oil, shaking after each addition.

Alcohol 10 oz., raw linseed oil 10 oz., dilute acetic acid 5 oz., nitric acid 4 oz.; mix and shake until dissolved.

CHAPTER V

THE GERMAN ACID METHOD OF FINISHING

THOSE who have the privilege of handling high-class cabinet furniture of foreign manufacture are not long in noting that each country's goods have some distinctive features about them that differ from those of others. Not only is this so as regards design and general construction, but there is something about the finish that is very noticeable. Probably this is chiefly due to climatic influences. From this cause alone a style of finish that gives excellent wearing results in one part of the world would be a dismal failure in another.

The cabinet furniture goods of France and England most nearly approximate to each other as regards their finish, mainly due to the fact that England, perhaps more so than any other country, has adopted the style of finish that originated in France. Hence we have the term, "French polish." For a very long time the Germans adopted the same method, with this difference: that on high-class goods that would stand the cost of labor they used pumicestone powder very freely in the early stages of the work, thereby gaining a perfectly level finish, much thinner in body than that generally seen on English-made goods; and as they had the advantage of using a much purer spirit for dissolving the gums, one might reasonably suppose that their work would be vastly superior as regards its wearing qualities, as well as in excellence of workmanship.

That this was not so is due not so much to the method of its application, for no doubt all three countries adopted practically the same method and approximately the same class of materials.

Unfortunately, in the distribution of the polish solution — as made from shellac and, in some cases, a small percentage of other gums, dissolved in alcohol — it is necessary to use a small quantity of oil to aid in its even distribution and easy working, and it is this use of oil before applying polish and with it, that creates a lot of trouble. There is always a tendency on the part of workmen to use a trifle more than is absolutely necessary.

Some gums work much more sticky than others, and while one brand of spirit may work very mild and not require much oil, another brand may work up hot or dry too rapidly to enable the work to clear out bright without using an excess of oil. Recognizing this, some workers use poppy oil instead of linseed oil, with a decided advantage. But whichever kind of oil may be used, it often happens that there is sufficient left behind, either lying underneath the polish or incorporated with it, that in time works out again to the surface, creating what is called "sweating." In most cases, as it works its way out, it breaks up the film of shellac into a cobwebby form and presents a cracked appearance, which, if not cleared off at once, becomes hard, in the form of minute ridges, to which dust clings and dusters drag when attempting to clean the surface.

While this oozing out of the oil is going on, the same atmospheric influences that cause it often create another trouble. It only requires a slight heat, prolonged for a few days, to soften up the shellac used as a polish. As it softens up again it sinks into the wood, on some woods to the extent of forcing the grain-filler out, so giving the work an unfinished appearance, as if it had not been completed, or at least done by an inexperienced workman.

This is especially noticeable on goods that are faced with very thin veneers.

Even by the use of a superior class of spirits the Germans were not free from these troubles, but were the first to seek out some means whereby the action of the oil could be overcome. This was to a great extent accomplished by what is known as "vitriol finish." This, in its way, was a grand achievement, but it only accomplished half what was required; it made no provision for the sinking in and loss of gloss caused by a heat wave, or the overheating of rooms by gas or fires, nor did it prevent the perishing of shellac polish likely to be caused by excessive dampness. Recognizing this, the Germans went a step farther, and on high-class goods abandoned the shellac finish in favor of one brought up by successive coatings of copal varnish, each coat allowed to thoroughly harden, to enable it to be ground down to a dead level with felt pads, pumice powder, and water. When this had been done some four or five times, French polishing in the strict acceptation of the term commences, the dull surface being worked upon with a polish made from bleached shellac, using a trifle more oil than is the usual practice when the whole of the work is being done with French polish. Thus we have what is sometimes called a "polish on varnish finish."

There is, however, this difference: the application of polish is not carried out to its fullest extent; that is, the final luster is not brought up by means of spirits only. The polishing is proceeded with to a stage when it is just ready for clearing out the oil and bringing up the luster with spirits. Instead of using this, the work is pounced rather liberally with precipitated chalk. Then having at hand a suitable vessel containing sulphuric acid diluted with about ten parts of water, the operator dips the palm of his perfectly clean hand into the acid solution and proceeds to rub the chalk with a circular motion, applying

sufficient of the acid so that the chalk becomes a creamy paste, then continues with the rubbing, using his finger tips to get it well into the corners and moldings, until the chalk dries off in a fine powder again. The effect of this is that the final luster is brought up by what might be called "hand-polishing"; the acid has the property of hardening the polish film of shellac, while the chalk brings away any oil that may be on the surface, and also acts as a polisher.

Those who may care to try this method of finishing their handiwork, yet hesitate to use the acid by their bare hands, may be interested to know that an efficient substitute will be found in the use of a soft quality of chamois leather.

From the foregoing it will readily be seen that the main principle of this process lies in the fact that only a small proportion of shellac likely to soften up is used, and the successive applications of varnish build up a surface first which prevents the possibility of any oil sinking into the wood to create a "sweating."

It has also brought about a revolution in the method of imparting color or staining. All this must be done before varnish is applied, otherwise it would rub off again, especially along the edges, when grinding down with pumice, while if color is used in the French polish on the top of the varnish it may soon be found that the acid has a bleaching action on aniline dye colors unless the acid is cleared off exceptionally dry.

CHAPTER VI

FINISHING VENEERED WORK

VENEER is simply a very thin sheet of hard wood; the staining and varnishing are the same as for hardwoods, only that as the veneer is thin and glued to a body of other wood the treatment must be varied and care must be taken that the glue is not affected by water staining, if that is used. Trouble is sometimes experienced with veneer grain showing up after finishing. First it is well to understand about the character of veneers; some is sliced, some is quarter-sawed, and still other plain rotary cut. Rotary-cut veneer, under proper treatment, finishes up practically the same as solid plain-sawed stock. Identical treatment should produce the same result in both cases. Ordinarily the raising of the grain of the wood after finishing is due to the wood not being dry when it is finished, either when finished at the machine or in the hands of the wood finisher. Take a job of solid wood, for example, and let the stock be put through the planer and sander before it is perfectly dry, and after it is finished with stain and varnish it is very apt to "grain out." Some of the grain of the wood shrinks away, leaving the rest of the surface to stand as if raised. Hence, if built up panels are sanded immediately after gluing and before all the moisture from the glue has dried out there will be a raising of the grain. Another probable cause of graining-out may be found in the use of veneer that had been too loosely cut, or it might come from the using of rotary-cut veneer with the wrong side out. Where the blocks have been properly boiled and the

pressure bar well fitted and carefully adjusted rotary-cut veneer is tight and smooth on the outside as it peels from the log, and is rather stiff to bend, as compared with loosely-cut stock, where the pressure bar is not doing its duty, or where the logs have not been properly boiled or steamed. Some veneer manufacturers indeed cut veneer 1-16 inch to ⅛ inch that is so tight and firm that it is rather difficult to tell the inside from the outside. On the other hand, there are those who cut it loosely, either from ignorance or carelessness, making a veneer that is simply a sheet of splinters held together by interlocking fibers. Veneer of this sort, as also veneer cut fairly tight but put on inside out is very likely to show up bad in the finish. Or an excess of sanding on the face of a finished panel may cut away so much of the wood of the top layer as to leave only what is practically the inside of the veneer, and is not as tightly cut as the outside.

Polishing Veneered Work.— After scraping up the wood, apply a coat of size for stopping up the grain, let it dry, then apply whatever stain you wish, and finally proceed to polish it. Do not use too much oil. The polishing is the same for all hardwoods, but for a stopping a size is used for dark wood, and plaster of Paris for light. Lime is good for staining Honduras mahogany, chestnut, etc.

Protecting Inlay Work or Marquetry.— Where inlay or marquetry work is used in connection with hardwood work it is difficult to avoid injuring the former in the filling or staining of the latter. Such work is usually seen in passenger cars, though less in evidence now than formerly. It used to be protected with shellac, but a better way is to add a little glycerine to glue and coat with that. The proportions of the two ingredients must be made to suit the temperature. Ordinarily this size may be taken off by means of a wet rag. Should it be rather difficult to do this, then use a scraper, which must be

managed very carefully if you would avoid scratching the wood. If the glue and glycerine mixture should prove difficult to remove, how much more so would be shellac. A workman in the Pullman shops gives this method: "After filling the woodwork clean up the inlay and marquetry with benzine and No. 0 sandpaper. I never have any difficulty in cleaning up such work, but I never pencil on shellac. We use satinwood exclusively for inlay and marquetry work, because in this wood there is no grain for the stain or filling to affect."

Waterproof Polish for Veneered Work.— This is an old and tedious formula, but is said to give fine results on small objects. Take raw linseed oil 1½ lbs., amber 1 lb., litharge 5 oz., dry white lead 5 oz., and dry red lead 5 oz. Boil the oil in a copper vessel, and suspend the leads in a small bag in the boiling oil, so that the bag will not touch the bottom of the kettle. When the oil has assumed a rich dark brown color take out the bag and put in a clove of garlic; repeat this six or seven times, continuing the boiling. The amber is to be fused or melted in two ounces of the oil before being added to the oil in the kettle. Then boiling is to be continued for a few minutes longer. Then filter, let it become cold, then bottle for use. Four coats of this polish are applied, each coat drying before another is applied. Rub each coat. With the last coat dry the object should be placed in a drying oven, and after removal it is polished by rubbing with a dry cloth, or in any desired manner to produce a fine polish.

VARNISH STAINS.

Varnish stain is simply a varnish stained more or less with one or more pigments. Such stained varnish is seldom used on architectural work or furniture, but is used chiefly in household practice, manufacturers putting up stains for this special purpose, and in various sizes of

containers. A great deal of these household goods are shellac stains, selling under various names, and with many more or less exaggerated claims. Such stained finishes may be prepared by simply adding any desired aniline dye to shellac varnish. The shellac is of course durable, but the coloring is not light-proof, hence not durable. The addition of a small amount of gum elemi will make such stained varnishes less brittle, and perhaps some of the household varieties contain this gum. The objection to the elemi is that it retards drying, even in small amount, while in excess it will cause stickiness. However, if exactly the right amount is added it will effect its object and not seriously affect the varnish.

There is also a liquid filler that is stained, and this may also be classed as a varnish stain, something between a varnish and an oil stain. It is a very quick-setting and brittle filling, and is lacking in easy working quality, which is so essential to good surfacing, and spreading and blending. It is used mainly on soft woods and on cheap work. Being a copal varnish, so-called, for it may contain not a little rosin, any oil pigment will mix with it, and the best are the fine graining colors. The addition of some raw oil, say about a fourth of the amount of varnish, will retard the setting and allow freer flowing. A stained filler should be applied thinner than when used without the stain in it, to admit of uniform covering and no laps. The following formulas are from a factory source:

Walnut Varnish Stain.— Dry burnt Turkey umber 100 lbs., raw linseed oil 12 gals., mix, and grind fine in a mill. Then add 5 gals. furniture varnish and 20 gals. of a strong drier in the mixing tank. Makes about 40 gals. of varnish.

Oak Varnish Stain.— Raw Italian sienna 100 lbs., with same amount of thinning, etc., as for the walnut stained varnish.

Cherry Varnish Stain.— 100 lbs. burnt Italian sienna, and thinning, etc., same as for walnut.

Ebony Varnish Stain.— 100 lbs. ivory drop black, with same thinners, etc., as for walnut.

The following formula is not from the factory:

Satinwood Varnish Stain.— Dissolve 1 lb. shellac (in scales), 8 oz. rosin, 2 oz. gum benzoin, and 2 oz. glue in ½ gal. alcohol; afterwards adding 8 oz. turmeric, or sufficient aniline yellow to color. Strain before using and apply with a camel hair brush.

CHAPTER VII

STAINING WICKERWARE AND WILLOW FURNITURE

THE wood must first of all be mordanted with lime water, this being prepared by slaking fresh quicklime with water enough to cause it to fall to pieces, and to powder, and to a pint of this fine powder add from fifteen to twenty pints of water; allow the lime to settle from the water, after having thoroughly stirred the two together, then pour off the clear liquid for use. The willowware manufacturer takes the willows and steeps them in the limewater for several hours, after which they are dried with a heat up to 100 deg. After the drying, and before they become cold, they are steeped in a fluid stain, brown stain being most used, although many other colors also are used. The following formulas are from an English source:

Brown Stain.— Dissolve an ounce of permanganate of potash in five pints of water, dip the willow into the fluid, lift out at once, and allow the object to drain off. This will give a pale brown, but by allowing more time for the stain to act various dark tones may be obtained.

Or, dissolve 4½ oz. of potash in 5 pints of water and steep the wickerware in the fluid for two hours, then boil them for two hours in a boiling hot solution of pyrogallic acid, made by dissolving 2½ oz. of this acid in 5 pints of water.

Or, dissolve 3½ oz. of catechu and 1½ oz. soda crystals in 5 pints of water by boiling, and steep the wickerware in the fluid for three or four hours, then dry them,

and afterwards steep them for one hour in a solution of 5 oz. bichromate of potash in 5 pints of water.

Blue.— Dissolve 2 oz. indigo carmine in a quart of water and soak the wickerware in the fluid for 5 or 6 hours.

Green.— Dissolve 2 oz. indigo sulphate and 1 oz. picric acid in 50 oz. boiling water; steep the wickerware in the fluid for several hours. Different tones of green are obtained by altering the relative proportions of the coloring matters.

Yellow.— Dissolve an ounce of picric acid in 5 quarts of boiling water, and steep the wickerware in it two hours.

All the foregoing bright colors are to be obtained only on fresh, clean stock, the wood being white. But if you have old work to stain it will have to be done with a stain that is somewhat darker than the original stain. Brown or black are best. Either of the two following formulas will answer the purpose. First wash the object to free it from all grime and dirt.

Staining Old Wickerware.— Dissolve 1½ lbs. of aniline nitrate and 1 oz. of chloride of copper in 9½ gals. of water: Boil the wickerware in the fluid for one hour, then place it in a boiling hot solution of bichromate of potash for a half-hour, using 8½ oz. bichromate to the gallon of water. Or this: Boil 25 oz. of logwood extract in 12½ pints of water containing 1-5 oz. alum. Filter or strain the fluid, and steep the wicker in it for from two to six hours. Keep the liquid at the boiling point all the time, then remove the wickerware and dry it, then steep it in a boiling hot solution of iron sulphate 15 oz. in 7½ pints of water for from two to four hours. This gives a more or less bluish-black with a gray cast, but by steeping it in a decoction of 13 oz. copper sulphate in 1¼ gals. water a deeper black will result.

Gray.— In the case of new wickerware it will be found that by coloring it a gray tone dirt and grime will not

show so readily as with the unstained wood. A good gray tone may be obtained by dissolving 45 oz. iron sulphate in 7½ pints of cold water, steeping the wicker in it for from two to six hours, and then, after drying, steep in a solution of 1½ lbs. pyrogallic acid in 5 pints of water.

The Aniline Colors.— The aniline dyes are much more effective than the foregoing mineral or chemical colors, as the anilines need no steeping, dyeing the wood at once. In fact, the staining liquid may be applied with a brush or sponge. Certainly for very bright colors the anilines are to be chosen. The wood should be mordanted with a solution of 6 oz. Marseilles soap in 12½ pints of water, soaking the wood in this and then drying it before applying the coloring. Anilines that dissolve in water are to be used, water of from 86 to 140 deg. being right. Stir the liquid well and then steep the ware in it until the depth of color is as you may desire. As the dye liquor becomes exhausted it should be strengthened by the addition of some freshly made dye solution. A very small amount of aniline will do.

Blue.— 1. Dark. Dissolve 3 oz. Bengal blue in 3½ pints boiling water, and stir and filter the fluid in ten minutes' time.

2. Light. Dissolve 3 oz. bleu de lumiere in ½ gal. boiling water.

3. Sky Blue. Dissolve 3 oz. bleu de ceil in ½ gal. of boiling water.

4. Greenish Blue. Dissolve 3 oz. bleu de vert in ½ gal. boiling water.

Green. Dark; Dissolve 3 oz. methyl green and ½ oz. bleu de lumiere in ½ gal. of hot water. Light: Dissolve 1 oz. of methyl green in a pint of boiling water.

Red. Dissolve 3 oz. coral red in 5 pints of water.

Dark Red. Dissolve 3 oz. fuchsine and 1 oz. of orange in 3 pints of water.

Rose Red. Dissolve 3 oz. rose Bengal in 5 pints water.

Violet. Dissolve 3 oz. methyl violet in ½ gal. water.

Reddish Violet. Dissolve 3 oz. methyl violet and 1 oz. fuchsine in ½ gal. of water.

Golden Yellow. Dissolve 3 oz. naphthaline yellow in ½ gal. of water.

Brown. Dissolve 3 oz. of Bismarck brown in ½ gal. water.

Chestnut Brown. Dissolve 1 oz. of maroon in a pint of water.

The list given includes only a few of the many colors that may be used, but they indicate the possibilities. The quantities specified produce a very concentrated stain, and if more were used the result would be a bronzing of the color. The formulas given are for strong solutions; they may be reduced with water to suit the work in hand. As the stain is used by successive dippings of the wickerware it must be strengthened from time to time with fresh dye.

The dyed wickerware is finished with a coat of lacquer, made and used as follows: First the article is dipped in a size of thin, hot glue or gelatin water, then it is allowed to dry. This closes the pores and gives a good surfacing for the lacquer. For white goods use the white or bleached shellac; for dark goods use a mixture of the white and orange shellac; some use a copal varnish instead, but lacquer is better, being more flexible and hence less apt to crack. For black work dark shellac is used.

Staining Willow Ware Furniture.— The stain will take more uniformly if the article is mordanted with this mixture: Take 9 oz. chloride of lime and 1 oz. soda crystals in 5 pints of water. Apply several coats of this mordant, allowing each coat to dry before applying the next one. Then apply a weak solution of sulphuric acid in water, and rinse at once in clear water. Let dry. Use alcohol aniline stain, as it will penetrate better than oil or water stain. But if water stain is used, apply it hot.

It requires experience to stain wicker successfully, hence if not successful at first, remember this.

EQUIVALENTS OF WATER COLORS IN ANILINE DYES.

Water Colors	*Aniline Colors*
Sap Green	Naphthol Green
Emerald Green	Emerald and Malachite green
Scarlet	Eosin and Biebrich Scarlet
Violet	Methyl Violet and Gallein
Burnt Sienna	Bismarck Brown
Ultramarine	Cotton Blue, Alkali Blue
Sky Blue	Methylene Blue
Lemon Yellow	Picric Acid
Golden Yellow	Naphthol Yellow
Magenta	Magenta
Cadmium Orange	Phosphine, Aurantia
Crimson Lake	Congo Red.

CHAPTER VIII

FINISHING NEW FURNITURE

FURNITURE finishing may be said to consist of three forms, as follows: The flowed or gloss finish, the wood being well filled with filler, and bodied up with varnish, resulting in a surface as uniform and smooth as plate glass. Rubbing is done with pumicestone and water, oil not being used because oil-rubbing would fail to give the right surface for varnish. The varnish is flowed on and allowed to stand until dry. Next comes the rubbed finish, to affect which several ways are in use. Several coats of varnish are given, with due time between each for drying, the coats are rubbed to remove gloss, the last coat being rubbed with pumicestone powder and oil to form a good surface. The grade of pumice used determines the finish, the finer the pumice the finer the dead-luster. Finally comes the polished finish. After the surface has been made fit as described in the first process, it is rubbed with flour pumicestone and water, as water cuts faster than oil and is easier to clean up. Grit gets into corners, etc., and is very difficult to get out, more so when oil is used. After rubbing with water and pumice and cleaning up, the surface is rubbed with powdered rottenstone and water, which removes the very fine scratches left by the rubbing with pumice. Then it is the custom in the best finishing rooms to take some polish and waste and rub the surface briskly, which causes a slight polish to appear. Next a large piece of muslin is wrung out in water, dampened with a little alcohol, and the work is quickly "spirited

off." This removes every vestige of cloudiness left by the polish. It is the saying in the finishing room that the best rubbing pad is the human hand. This is done on some of the better grades of work, a little polish being placed in the palm of the hand and the workman proceeds to rub the work in a certain skillful manner. This is known as hand-polishing, and it is continued until all marks made by the former rubbing are entirely obliterated.

Rubbing requires considerable skill, born of long experience, and no description of the art would suffice to make a competent workman, although it will help him. It is very important that the varnish be not rubbed too much, for it is easy to cut through and spoil the work.

Too close rubbing will cause the varnish to sweat, and the varnish will likely be blamed for this. Should this occur, then wait a day or two before rubbing to a finish. If the oil is allowed too long on the work it will soften the varnish, which will rub off in spots, more particularly when rubbing with oil than with water. Allow at least two days for drying before rubbing, and three days would be better than two. Try the surface with the finger nail, and if it easily dents it is too soft for rubbing. If you use oil in the rubbing, be quick, and don't allow the oil to remain on longer than necessary. Some finishers prefer crude oil for rubbing with, rather than water or other oil. Some use coal oil. In any case, where oil is used the work must be cleaned up with benzine and a rag. Wipe dry with a clean rag. It is thought by some that coal oil cuts faster even than water.

Never rub across the grain of the wood, for it will cause scratching. Don't bear on heavily, at start or finish, or you will get the ends worn too smooth; bear on gently and with even pressure all the way through. Never rub the varnish until it is perfectly dry, for that will cause sweating when you come to rub it again.

Stained work should always be rubbed the way of the grain, never across it nor in a circular manner, for that would cause the marks to show at the finish. This is particularly true as regards water-stained work. If the filler has been stained to match the wood it helps the solidity of the work. The amateur will think that the more pumicestone he uses the faster his rubbing will cut, but that is not so. Use only enough pumice, which is very little. Rub in a rotary manner, evenly, from one end of the work to the other, and once in a while try the surface with your thumb, to note progress of the cutting process.

A pad of felt about three by five inches may be used as the rubbing pad, but for irregular surfaces prepare a piece of wood to conform to the work, and glue a piece of felt to it; for water rubbing cement it with shellac. For rubbing with, first dip the rubber in the liquid you are to rub with, then dip into the pumice. For moldings and carved work roll up some haircloth until it is about ¾ inch thick, then unravel the ends, making a sort of brush.

It is handy to have a box made to hold the liquid and powder. Take a piece of board about 15 inches long, about 8 inches wide, and sides 5 inches high, with only one end covered, the sides being made to slant or taper down towards the open end. Take a two-pound color can and put into it equal parts of crude oil and benzine; in another and shallower vessel place the pumicestone, or place it on the bottom of the long box.

Finishing Cheap New Furniture.— Owing to competition the maker of the cheaper grades of furniture has reduced the finishing cost to the minimum. Of course it is easy enough to get out nice looking cheaply finished goods, but unless the finish has durability the maker will find himself on the blue list. But whatever else he may do to lessen cost of finish he must not cut down on the filling, for this is the foundation, on which must stand

or fall the whole finish. Nor can he put cheap, inexperienced labor on the filling, for it will not pay; a skillful workman will do twice the amount of work in a day that an inexpert workman will do, and the work will also be done right. Hence it would seem that in the matter of cutting down expense here in the filling he can hardly go any further. The work must be done well and quickly.

It goes without the saying that only the straight grain oak goes into cheap grade furniture. For the filling take from 12 to 14 pounds of paste filler to the gallon of thinners. Allow the filling to stand until it turns gray. Right here is where most filling trouble comes in, the filler is rubbed off too soon, it does not have time enough to settle down into the pores of the wood. To wipe off while green or wet is easier than the same operation after the filler has become partly dry, or gray. Then too the filler is not always rubbed well into the wood. Excelsior and shavings are too coarse for rubbing off with, nothing being better than tow. Excelsior will take it off in streaks, while tow will gather the filler as you rub and form a good pad.

After rubbing out the filler let the work stand from 24 to 48 hours, then sandpaper lightly, using paper that is partly worn, or soft, so that it will not cut the corners, etc. On cheap work it is not often the filler gets sandpapered, but just a little rub will take off any grit, etc., and make a very much better surface, and at the expenditure of little time or cost.

Let us suppose that the job has left the filling room in good condition. Now we will first-coat it, a very important matter. This should be a surfacer with a good mineral base, silex. Such a surfacer or first-coater makes a hard, firm surface, one impervious to varnish, so that the varnish is held out well. Such a surfacer is easily applied, easy to sandpaper, and covers well. As the surfacer is capable of covering well it makes a very econom-

ical coating. After it has become quite dry it may have a heavy coat of rubbing or coach varnish.

Furniture Varnishes.— Some of the furniture finishing varnishes contain three times as much oil as gum, and while such a varnish is very durable, it never becomes quite hard enough for furniture, being likely to become tacky when subject to warmth or long continued pressure. But most furniture may be finished with twice as much oil as gum; such a varnish will in three weeks or so become hard enough to rub; and I have mostly finished tables, etc., entirely with such a varnish from the wood up, and successfully. But it requires months to do it, though if extreme durability of finish is wanted it will pay.

Years ago, but within our recollection, kauri gum was considered low-grade stock, it was the cheapest gum used for making varnish, and the furniture varnish was made entirely of it; how we wish it were so abundant and commonplace now. I heard of a piece of furniture done twenty years ago with kauri gum polishing varnish, and its luster is as good as ever. Nowadays it is quite common to hear complaints of the polished jobs growing dim even before they can be shipped away to market. And maybe the trouble is not entirely with the varnish, but with the price, as many are giving a dollar a gallon less for polishing varnish than they used to give.

We do not as formerly hear so much about the expert varnish maker and his trade secrets; there are indeed trade secrets in the varnish factory, but some of the secrets have leaked out. In fact, anyone may know all about varnish and its making at the cost of a very few dollars, invested in books or trade magazines. However, it is well known that the most expert varnish maker cannot make good varnish out of poor materials. The demands for cheaper and still cheaper varnish has obliged the varnish maker to employ the most skillful

chemists to devise ways and means for making goods that will meet this demand. A polishing varnish made with Manila gum will of course polish, but the finish will lose its luster in a very brief time. A kauri gum varnish with some rosin in it will do the same, and it also requires longer rubbing to produce a polish. Kauri gum is not extinct, neither is its price prohibitive, hence it would be better to buy that kind rather than take chances with an inferior grade, with the idea of saving a little on the price of the varnish, which you may more than lose in the finishing room.

CHAPTER IX

MAKING ANTIQUE FURNITURE

IN the case of oak, as each job is made it receives a coat of white lead paint, which is allowed to thoroughly dry. It is then completely removed by the aid of caustic potash and a steel wire brush, which not only cleans off the paint but tears away the softer fibers of the wood and at the same time considerably darkens it.

Sometimes it is necessary to give the work the appearance of having been exposed to strong sunlight for a considerable time. This is effected by bleaching it with either dilute hydrochloric, sulphuric or oxalic acid. When it requires to be darkened it is put into an air-tight chamber and subjected to the fumes of ammonia until it becomes the required shade.

In finishing off, a wax polish, to which burnt umber has been added, is applied and so manipulated that, while the flat surfaces of the job are quite clean, the corners are dirty-looking, thus giving it the appearance of being carelessly dusted for a considerable time. A preparation of butter of antimony is then applied to harden the wax, and the job is ready for a customer.

Mahogany is treated in very much the same way as regards the painting and subsequent scrubbing. When it is thoroughly dried after the removal of the paint it is smoothed down with coarse glasspaper, using the hand only instead of a flat glasspapering cork. The effect of this is to remove all traces of the previous operation and to leave the surface of the wood quite coarse. It is then carefully washed over with a saturated solution of potas-

sium bichromate to darken it, and to develop the figure of the wood. The next operation is to apply several coats of boiled linseed oil, adding to the oil sufficient driers to dry it properly. When this has become perfectly dry and hard, sandpaper it smooth and rub with raw oil, or Frenchpolish it if not too much trouble and expense. Walnut is done the same way as mahogany, except that carbonate of soda is the darkening agent instead of potassium bichromate.

CHAPTER X

RE-FINISHING OLD FURNITURE

THE first thing to do with an old piece of furniture that is to be re-finished is to go over it and ascertain what repairs may be needed. This work may or may not require the aid of the cabinet maker, depending upon the amount and character of repairs needed. Save the bits of veneer that come off, if any, for fitting in defective places. When skillfully done the patching will not be noticeable. After all repairs have been made take the piece in hand for re-finishing. Make smooth and solid all surfaces, using steel wool or sandpaper, and scraping off or otherwise removing old varnish. In some cases the varnish may easily be removed by coating it over with a hot glue size, which allow to dry in a warm room, over night; in the morning, if conditions were favorable, the most of the varnish will be pulled off by the action of the drying glue. The balance of it may then be removed with sandpaper or steel wool. Alkali, alcohol, and other liquid removers are messy and not nice to handle, hence if the glue trick will suffice, so much the gain. Otherwise use any of the removers named and described in another place. The hot glue will not remove paint, nor varnish under certain conditions. The condition of old varnish which glue will remove is that where it adheres very slightly to the wood, as with most very old varnish coats. Recently applied varnish it will not take off. In drying, the glue contracts very strongly, hence if the surface to which it has been applied is not perfectly solid it will pull it away.

This fact is made use of in glass embossing or frosting, the glue pulling away the thin face of the sheet of glass.

After making the piece smooth, dust it off well, then examine for colored and uncolored places; it may need touching up with color. I prefer to go over the entire piece with a colored oil stain, rubbing this in well, and rubbing off every vestige of surplus, then leaving it to dry. If then there are parts lighter than the body of the work I touch these parts up with suitable color, let it dry again, then lightly rub entire job with curled hair or moss, which will remove any specks and take off any gloss. This going over the work with a stain, even though with a hard wood it may not seem to sink in, gives it a uniform appearance. Of course in some cases it may be necessary to stain the whole piece in the usual way. Add a little japan driers to the stain in any case, as the oil alone will not dry quick enough.

Now, if the piece looks uniform of color, fit to take the varnish, then apply varnish, using ordinary good furniture varnish. If only one coat is to be given, lay it on rather heavy, flowing it out well, and brushing it out even and level. If two coats are needed, let the first coat be rather thin, and when it has stood forty-eight hours rub down lightly with steel wool or fine sandpaper, dust off, and apply a full coat of furniture varnish. As regards both the amount of work and the quality of varnish used, it will depend on the character of the work, whether cheap or costly, or medium. This matter the finisher can determine. There are several grades of furniture varnish, and where one has little refinishing to do, or in any case, for that matter, he might well use the best; a few cents' worth of the very best varnish will probably do for any ordinary piece of furniture. However, a fairly good grade will last well and have a good luster. Of course, all furniture finish is in full luster.

Some old furniture may require simply a sandpapering lightly with fine paper or steel wool, and a coat of light-bodied varnish. Or if the piece needs merely a cleaning up and reviving, then all there is to do is to clean off with a rag and a furniture reviver, which see in another place, to remove dirt and grime, then a brightening up with a polish, which also see. Or it may be well to first wash off the piece with good soap and water, wash off again in clear water, and dry with a so-called chamois cloth. In all cases the workman must use his judgment. And if working for others, as this book is designed for the shop, not the home, it will be well to give the customer rather more for his money than he might expect; that is to say, give him if anything a little better job than you had given him to expect. This will win and hold trade. The re-finishing of old furniture is a large and profitable kind of trade, and well worth giving time and attention to. You can use a cheap rosin varnish that will dry in a day, show a very brilliant luster, looking fine, yet will go to pieces inside of a year.

Enameled Furniture.— To do up a piece of furniture in enamel get a good ground of white lead and zinc white, thinned with turpentine, adding a little bleached linseed or poppy seed oil, and white japan driers. Make smooth, then apply two coats of quick-drying flake white, thinned with turpentine, sandpapering the last coat smooth. Then apply the coat of enamel. This may be bought ready for use, or made from finest French zinc ground in hard white enamel varnish; let a coat of this stand three days, then rub with fine pumicestone powder and water. In twenty-four hours after this apply another coat of enamel, and let dry two or three days. Then moss off and hair down with flour pumicestone and water. Wipe dry and polish with powdered rottenstone and sweet oil, if smooth. If not smooth, it may be best

to apply another coat of enamel, which polish, and this ought to give a surface smooth as polished glass.

The enamel may also be tinted any desired color.

Cheap work may be done with much less labor, as the first or ground coat may be of glue size and whiting. Two coats of this will be found best, although one coat only is used on cheap furniture in the factory.

When buying enamel for cheap furniture, get what is known as " Special Furniture Quality," some paint makers putting out a very hard-drying yet fairly elastic enamel paint for this purpose.

Repolishing.— When a piece of cabinet work or furniture requires repolishing, it is best to take the object apart as far as possible, which will facilitate the work greatly and permit of a cleaner and more thorough job. Remove the fixtures, such as handles, etc. Rust dirt under these things may be removed by rubbing with a paste made from fine emery flour and turpentine. Then make clean the entire surface of the work, using soap and water, or acid, or whatever will effect the cleaning best. Then give a coat of clear oil, rubbing this off well. It will then take the repolish better. Repair any broken places, such as dents, by several coats of shellac which, when hard, may be sandpapered smooth and level.

Coloring Up.— The chief colors used by polishers for " coloring up " are black and red. The black polish may be made by mixing gas-black or lamp-black with thin polish — *i. e.*, half polish and half alcohol, and then straining it through a piece of muslin. Another way is to mix a little aniline " spirit black " with the thin polish. This is the readiest way, but is not as permanent as gas-black.

Red polish may be made by mixing Bismarck brown with thin polish. This is the red polish mostly used by the French polishers.

Having got our color ready, we will mix a little of the black with some very thin polish until we get the depth we require. Care must be taken not to get it too strong. In coloring it is better to give two or three coats of weak color rather than risk getting it too dark; but should we get it too dark we can wash it off again with alcohol.

We will now suppose we have made the light parts dark enough, but we find they are not the same shade as the other parts — not brown enough. We can remedy this by mixing a very little of the red polish with some thin polish, as we did with the black, and color with this. As these colors are transparent, one color will show through another, so by coating the black over with a red we produce a brown.

Furniture Polishes.— The character of the furniture and work required to be done will determine what kind of polish should be used when it is desired to revive the finish. One of the most popular polishes now for old furniture is made from beeswax and turpentine to about the consistency of soft butter. It is applied by means of a rag in a thin film, then in a few minutes the surface is well rubbed with a dry woolen rag, producing a fine polish. But such a finish is affected by water. A better finish, one not affected by water, is made by melting three or four bits of gum sandarac about the size of a walnut each and adding one pint of boiled oil, boiling the mass for one hour. When taken from the fire and allowed to cool, add one dram of Venice turpentine, and if too thick add also a little ordinary turpentine. Apply a coat of this to the furniture and let it stand for a few hours, after which rub off clean. The furniture then should be rubbed daily to keep it clean, but a fresh application of the polish will not be necessary more than once in two or three months, possibly longer. Scratches may be removed with the rubbing in of a little of the polish.

An authority gives the following method for doing up

old furniture: Place in a quart bottle the following ingredients, in the order in which they are named here: 1 gill of powdered rottenstone, 1 gill of cold-drawn linseed oil, 1 gill of turpentine, 1 gill of naphtha, 1 gill of strong solution of oxalic acid, ½ gill of alcohol, 1 gill of cold water; to which has been gradually added a teaspoonful of sulphuric acid. Dip a piece of felt (an old felt hat gives the material if no other is at hand) into the mixture, which is to be poured out into a saucer, and rub the work in a circular manner, beginning at one part and slowly working toward the opposite part, in the usual way; avoid rubbing too long in one place. Do only a portion of a surface at a time. On some surfaces flour pumicestone may be used in place of rottenstone. This liquid is said to remove white marks from varnished surfaces.

Furniture Cream or French Re-Polisher.— In 1 pint of 95 per cent. alcohol put ½ oz. of gum copal; first pulverize the gum and sift through a fine sieve or cheesecloth, to facilitate the dissolving. Then add an ounce of shellac to the mixture. Place all in a tight bottle and put in a warm place until perfect dissolution has taken place. Shake now and then, and in two or three days the gums will have dissolved. Then strain through cheesecloth and bottle again, keeping tightly corked when not in use.

Furniture Revivers.— Wax does not answer on French-polished work, but for other kinds of finish it does very well, and for some woods the addition of a little coloring is well, say red sanders wood. For reviving French-polished work try this: Take equal parts of turpentine, strong vinegar, alcohol, and raw linseed oil, and place them in a bottle in the order here given; this is essential in order that curdling may not occur and so spoil the mixture. This is recommended as being a superior reviver.

French Polish Reviver.— Another one, and a formula very old and always popular, is this: Beat up gum arabic and the whites of two eggs in a mortar or other suitable vessel until they amalgamate. Then add ½ pint each of raw linseed oil and pure sharp cider vinegar, 8 oz. of alcohol, 1 oz. of hydrochloric acid, and 2 oz. of muriate of antimony. Rub the furniture with this until a polish appears. The finish will prove to be a very durable and pleasing one.

Another and very good polish is made upon this formula: Powder fine 1 oz. of seedlac, 2 drams gum guaiacum, 2 drams dragon's blood, and 2 drams gum mastic, and place in 1 pint of alcohol. Place in a stoppered bottle and expose to a moderate heat for three hours, or until the gums have dissolved, then strain through muslin, bottle, adding a tablespoonful of raw linseed oil, all well shaken together. This polish is intended for the darker woods, as it would discolor any very light-colored wood. It is particularly fine for cherry or mahogany, owing to the reddish hue imparted by the dragon's blood.

Derby Cream.— Derby cream is a very old and reliable reviver made by adding 6 oz. of raw linseed oil to 3 oz. of acetic acid. This is well stirred, then ½ oz. of butter of antimony and 3 oz. of alcohol are added.

Furniture Renovating Polish.— Melt in a vessel that is to be placed within another vessel containing hot water, white wax ½ oz., rosin ½ oz., and ¼ dram Venice turpentine, stirring until the mass is dissolved. Pour out into another vessel and pour into it while hot 5 quarts turpentine. Let the mass stand two hours, when it will have become like vaseline or soft butter. Make the furniture or piano that is to be renovated perfectly clean, washing off with soap and water and drying with a clean cloth, or chamois skin. Rub in the polish with a soft bit of rag, and rub to a polish with felt or dry cloth.

Melt together with gentle heat 3 oz. spirits of turpen-

tine and 4 oz. white wax, in an earthen vessel, covering it so as to keep in the fumes of the turpentine. Allow the mass to cool, until it is almost firm, then add 2 oz. of alcohol and mix well together.

Melt together 2½ oz. yellow wax, 1 oz. white wax, 1 oz. Castile soap, 10 oz. turpentine, 10 oz. boiling water and 1 dram carbonate of potash. The best way is to melt the waxes and turpentine together, and separately dissolve the soap and potash in the hot water by boiling until the soap is dissolved, and then stir in the wax and turpentine compound while the latter is still hot; after removing the mass from the fire continue stirring it until it is cold, so as to prevent the wax granulating.

FURNITURE POLISHES AND REVIVERS.

1. Mix equal parts of sweet oil and alcohol and shake well together. Dip a wad of raw cotton in the mixture and rub the object with a rotary motion.

2. Shake well together equal parts of turpentine and raw linseed oil, and apply with a rag; remove surplus oil with a rag, leaving the surface free of oil.

3. Crude petroleum oil is one of the best renovators, and kerosene oil also is very good. Neither, however, leave any polish, as the oil evaporates in time and leaves a dull surface, which must then be rubbed to a polish; the oil simply cleanses the surface.

4. Here is a recipe of date 1777: For polishing mahogany or walnut furniture, take 2 oz. butter of antimony, 2 quarts strong cider vinegar, ½ pint raw linseed oil, and ½ pint of ale; beer will not do. Mix the antimony with the oil, then add the ale, place in a half-gallon demijohn, and shake well with the vinegar. Shake well before using, and apply with a soft woolen cloth.

5. Mix together raw oil 1 pint, spirits of camphor 2 oz., vinegar 4 oz., butter of antimony 1 oz., liquid am-

monia ½ oz.; keep in a corked bottle, and shake before using. Apply with soft cloth, and rub to a polish with soft old rag, flannel or silk.

6. Mix together 1 quart of raw oil, ½ pint grain alcohol, ½ pint turpentine, and 2 oz. butter of antimony. Place in a bottle and shake well before using.

7. Raw oil 1 pint, grain alcohol 2 oz., butter of antimony 4 oz. Mix and shake.

8. Acetic acid 2 drams, oil of lavender ½ dram, grain alcohol 1 dram, and raw linseed oil 4 oz. Mix.

9. Raw oil 1 pint, rose pink 1 oz., and alkanet root 1 oz.; macerate in a mortar or other suitable vessel, and let the mass stand for a few days, then decant the liquid portion for use. The addition of coloring is for woods requiring color, as mahogany, rosewood, walnut, etc.

10. Raw oil 1 pint, shellac varnish 4 oz., turpentine 2 oz., alkanet root 2 oz., scraped beeswax 2 oz. Macerate and steep the root to extract the color.

11. Mix well together 1 pint raw oil, ½ pint shellac varnish, and ½ pint alcohol.

12. What is known as " furniture paste " may be made by dissolving 6 oz. of pearlash in 1 quart of hot water. Add ½ lb. of white beeswax and let it simmer for 30 minutes in an earthen pipkin. Then remove from fire and skim off the wax when it is cool. When needed for use, add a little hot water to the wax and work up into a paste.

13. Take equal parts of turpentine, boiled linseed oil and white vinegar. Apply with a cloth and rub. This polish will remove scratches which so often disfigure furniture.

14. Olive oil 8 oz., oil of amber 8 oz., tincture of henna ½ oz. Keep in tightly corked bottle and shake before using. Apply with a soft brush or cloth and rub to a dry polish with soft cotton cloth.

15. One quart pure cider vinegar, 2 oz. butter of anti-

mony, 2 oz. grain alcohol, and 1 quart raw linseed oil; shake well before using.

16. The following is a simple home-made cream: Shred fine 2 oz. of Castile soap and 2 oz. of beeswax into a jar with ½ pint of water, and set this jar in a moderate oven until the contents are perfectly dissolved. When quite cold, mix into it ½ pint of turpentine and 2 tablespoonfuls of vinegar, stirring these in. This cream should be stirred occasionally while in the oven.

17. For old rosewood needing renovating, try this: Put into a pan 2 oz. yellow wax, ½ pint boiled linseed oil and 1 oz. boiled alkanet root; stand this pan in another three parts full of boiling water, and leave it till the wax is perfectly melted and the whole is well colored with the alkanet; then strain it and when cool add to it a gill each of vinegar and turpentine; mix well and use. This "fetches up," to use the technical phrase, old mahogany, or, indeed, any dark wood.

18. To clean and renovate old oak furniture, dust off carefully, then wash off with warm water and Castile soap-suds. Let it dry, then rub with thin wax polish with a soft rag to a polish. A plain surface may be nicely polished by rubbing with the palm of the hand, the heat generated and the natural oil of the skin combined producing the very finest polish.

19. Splashes of dirt on polished furniture may be removed with soap and water, after which let it dry, then rub with a mixture of alcohol and raw linseed oil, or alcohol and turpentine, well shaken together. This has both a cleansing and polishing action, the polish being retained for a long time if well rubbed in and the surplus well rubbed off.

20. Another good preparation for the purpose is a solution of stearine in turpentine and a little alcohol, care being taken not to use so much stearine that white streaks are produced in the mass. When the turpentine and al-

cohol have evaporated, the wood is well rubbed with a woolen rag. This gives an excellent polish that can be renewed by rubbing when dimmed.

As a rule, furniture in these days suffers from too much furniture polish rather than too little. The delicate surface for which old pieces are famous, known as "egg-shell gloss," was obtained by hard rubbing. There is an art in applying furniture polish. First, carefully remove all dust and dirt, stains, etc., then with a flannel apply a very thin film of furniture cream to the wood; take a duster in each hand and rub up the wood the way of the grain till on touching the surface with your hand it leaves no mark. For the last polish use a clean old silk handkerchief. Of course, if it has been once neglected, wood takes a long time to recover its condition; but once this is attained, it takes relatively but little trouble to keep it in good order. Furniture polish applied too thickly smears and becomes a regular dust trap.

CHAPTER XI

HOW TO TREAT STAINS, WHITE SPOTS, ETC., ON FURNITURE

White Spots.— White spots caused by hot dishes may be rubbed lightly with a rag moistened with grain alcohol. This must be done very deftly in order that the spirit does not injure the varnish. Then rub with linseed oil.

It is said that dilute oxalic acid will remove the white spot. In any case it is best to apply the remedy as soon after the accident as possible. And rub with sweet oil or raw linseed oil afterwards.

Spirits of camphor is another remedy, rubbing the spot until the white goes. Then rub with oil.

Better still is camphorated oil, which is simply sweet oil and camphor well mixed. This is also said to be a good cleanser and polisher.

William E. Wall recommends holding a hot sad iron near the white spot, being careful not to over-heat the varnish and soften it. Then polish with oil on a rag. While it is the moist heat of the plate that causes the white spot, it is the dry heat of the iron that causes the white to disappear by gently fusing the gum in the varnish.

Mr. Wall says that the quickest and most effective way he knows is to apply a small piece of salted butter to a folded rag and rub the white spot briskly. A few minutes of this rubbing, he says, will erase the white spot. He adds that he has repeatedly used this method with success.

It is also said that olive or sweet oil or cottonseed oil and salt applied to the white spot and allowed to remain an hour or so will prove efficacious. Spread the mixture on lightly, and after an hour or so remove it with a dry and soft old cloth.

Another man tells of using a hot iron, but advises following it with a polish made thus: ½ pint each of turpentine and raw oil, and 1 gill each of alcohol and vinegar, shaking all together well before using. This also makes a good cleanser and reviver.

White on mahogany caused by dampness may be rubbed with a soft cloth moistened with a little sweet oil. Rub it well.

Alcohol marks may be treated by sprinkling some dry sal soda, powdered, on the wet spot and allowing it to remain a few minutes. Then wet a rag with kerosene oil and rub the part. Then rub the entire top with the rag and soda, then rub with a clean cloth to a polish. When alcoholic liquor, or lemonade, etc., are spilled on a polished table top, it should at once be washed off with clear warm water, using a soft cloth, after which rub dry and polish with a suitable polish or reviver.

Water will cause white appearance on varnish of inferior grade, due to presence of rosin. There is no remedy but revarnishing over. Or try 2 oz. oxalic acid and 1 oz. butter of antimony to 1 pint of water.

White marks are usually difficult of removal. Some use chloroform, some scrape the spot and revarnish.

Varnish Bloom.—A wood finisher says: "If ever troubled with that blue-gray bloom appearance on highly-polished furniture, you may feel perfectly safe in using the following formula: To about 1 quart of clear water add 1 tablespoonful of strong vinegar. In this saturate a piece of soft cheesecloth and then wring it out as dry as you can. Rub the surface lightly with this, and dry with another piece of cheesecloth. If the first treat-

ment fails to effect a cure, repeat the operation in about a week, and you will have the satisfaction of not seeing that cloudy look again, and your piano or furniture looking bright as at first."

Furniture Looks Dull.— When varnished furniture begins to look dull and dingy, the result of the action of coal gas, dust, etc., wipe it off with a soft cloth dampened with benzine; then let the work stand an hour. Then make up some suds with white Castile soap and wash the furniture with it, using a soft cloth. When dry, polish with a soft cloth.

Stains on Furniture.— Make up a polish as follows: One pint of grain alcohol, ½ oz. pulverized rosin, ½ oz. brown shellac; mix together. The alcohol will cut the rosin and shellac, after which mix in 1 pint of raw linseed oil, and shake up the mixture. Rub the article with this on a soft cloth, after which rub to a polish with cloth and flannel.

Finger Marks on Piano.— Vinegar or acetic acid diluted a little with water makes a good cleanser. A rag or soft sponge dampened with alcohol and deftly passed over the finger marks will remove them, but it must be done carefully, or the alcohol will injure the luster of the varnish.

Greasy Look After Polishing.— If you use a polish or reviver that contains oil, and you do not carefully clean away the surface, some oil will remain to make the surface clouded or greasy looking, to remove which use good vinegar. Acid is always a good addition to a reviver.

Bruises on Furniture.— If the bruise extends down into the wood, wet the part with warm water, which will swell the sunken part to a level of the surface, and after it has become dry you can sandpaper it down smooth and level. Then stain it and putty if needs be. Another way is to fold some brown paper and wet it, lay it on the

bruised part, and hold a hot iron over it until the water is evaporated from the paper. If one application is insufficient, try a second. A very small bruise will need no paper, merely holding the hot iron over the bruise being sufficient. Such injuries call for careful treatment, but when carefully done it is hard to detect the repaired part.

Fine Cracks in Mahogany.— Mix up some dry Venetian red with thick gum arabic mucilage into a putty, and press this well into the cracks. The same result will apply to other woods, observing only to color the putty to suit.

Restoring Color to Old Mahogany.— Add ½ oz. alkanet root in small bits to a pint of raw linseed oil, and when this has stood a week add a ½ oz. of powdered gum arabic and 1 oz. of shellac varnish. Let the mass stand in a bottle in a warm place for a week, and then strain it. Wash the surface of the wood with slightly soapy water, rinse, wipe dry, and polish with the preparation, using a soft woolen rag or chamois skin.

Specks on Rosewood Piano.— The minute specks seen and which greatly disfigure the surface, are caused by an oil that exudes from the wood, and which cannot be held back even with shellac. Rubbing down and revarnishing is the only cure.

Pitting of Varnish on Piano.— This may be remedied by rubbing it over with a hard wax polish. Make this wax by melting together ½ oz. Carnauba wax, 2 oz. japan wax, or white beeswax will do, and 2 oz. ceresin wax. Place all in a pot and melt by placing the pot inside of another vessel containing hot water, which place on the stove. When melted add enough kerosene oil to make the mass, when cool, about like petroleum jelly. Test by placing some on a glass and letting it cool, and if it becomes too hard upon cooling, add a little more kerosene. Apply with a woolen pad, made by rolling up a strip of

woolen like tape. It will be necessary to give it two or more applications, the idea being to fill the little pits in the varnish.

Discolored Woods.— Woods naturally discolored cannot well be remedied, though bleaching powder may help. Artificial or accidental discolorations may be removed in most cases by the application of a strong solution of oxalic acid, or with one part muriatic acid to five parts water. Ink spots may be treated with oxalic acid. Spirits of nitre is another cure for ink on wood.

Aniline Stains on Hands.— After staining some work and you find your hands well stained, the problem is how to remove the color. First wash the hands with a little bleaching powder, then with alcohol, following this with a washing with some soap, sapolio being about the best.

Cleaning Dirty Varnished Surface.— Try one part of muriatic acid in six or seven parts of water. Vary the proportions to suit the nature of the case. The stronger the dirt and grime the stronger the acid needs to be. Railroad car men use this.

Here is a paste that has been recommended: Starch flour or wood pulp 40 parts, hydrochloric acid 45 parts, chloride of lime 16 parts, turpentine ½ part. Mix these thoroughly into a paste. Cover the varnished work, whether on wood, metal or stone, with this paste, and allow it to remain for some hours. Then remove the paste, and this may be done by rubbing it briskly with a piece of soft leather or a brush, which removes all dust and dirt, leaving the surface perfectly clean. Rub with a cloth or soft leather to produce a polish. The chloride of lime keeps the paste moist, and permits of the removal of the paste without injuring the surface of the varnish.

Bleaches.— There are several chemicals that may be used for bleaching out woods, vinegar or acetic acid being the most common, with oxalic acid most in favor

for very dark stains, ink, etc. Use acetic acid and vinegar full strength. Use oxalic acid at the rate of one lb. to the gallon of water. Vinegar or acetic acid are sometimes added to the oxalic acid, the solution being used hot or cold as desired. Muriatic or hydrochloric acid, to which has been added some zinc metal, to " cut " the acid, is a bleacher. Nitric acid diluted with water is still another.

Sticky Pews.— The cause of pews and seats in churches becoming sticky is due, not to the use of poor varnishes, though this may sometimes contribute to the cause, but to the damp and impure air of such places, where ventilation is poor, and the atmosphere reeking with ammonia and gases. Sometimes the trouble comes from revarnishing over greasy seats. In any case, where the varnish is sticky, either remove the varnish or coat it over with very thin shellac varnish, using the brown shellac. Two thin coats are better than one heavy coat. Over the shellac you may apply a coat of best pew varnish, if desired. It is best to use pew varnish, as this is made with a view to standing the conditions met with in such a place. Some advise merely rubbing the sticky varnish with japan, but this is a very poor makeshift.

Care in Rubbing With Chamois Skin.— Never rub a varnished surface with a dry chamois skin, as it is very apt to scratch the surface. The skin gathers dust and dirt, and this in passing over the varnish does the scratching.

Ink Spots.— Try spirits of nitre or nitric acid, and when the spot turns white wipe it off with a soft cloth. It may be necessary to give two applications, but the cure is said to be sure.

Rust Stains.— Rust stains may be removed with Russian water, made from oxalate of tin in a solution of oxalic acid.

Stains on Wood.— Put an ounce of oxalic acid in one

gill of boiling water, and touch the stain with it. If this proves ineffectual, try nitric acid in water.

Dirty Hardwood Finish.— Give it a coat of kerosene oil and let it remain on for an hour or so. This to soften up the dirt or grime. Then rub off with a cloth, and wash with soap and water; then wipe dry. Next rub with crude oil, then polish with felt or old flannel. In an hour or so polish with soft old linen rag. If the part is very dull, dirty and scratched, instead of washing with soap and water, add more oil, and sprinkle pulverized rottenstone over it; rub gently and regularly, first with a circular motion, and then with the grain of the wood. When the surface has become smooth and bright, wipe off the rottenstone and finish as you would after the washing with soap and warm water.

Bleaching Stains.— If, after we bleach the stain with oxalic acid, we will sandpaper the work and apply a mixture of caustic lime seven parts and sal soda one part, the bleaching will be greatly improved, says an expert.

White Mark on Wax Finish.— If water is allowed to get on and stay on waxed surface any length of time, it will cause it to grow white, to cure which a manufacturer of wood finishing materials says it may be rubbed with a soft rag moistened with alcohol, after which rub on a little linseed or sweet oil. He says this will permanently remove the white spot, but cautions against getting water on wax, as a wax finish is not made to stand against water.

Protecting a Wax Finish.— But wax finish may be protected against water or any form of dampness by a coat of the following: Zanzibar copal varnish 6 parts, boiled oil 6 parts, and turpentine 10 parts, all by weight, all well mixed together, then applied. While protecting the wax it will not destroy, but preserve the waxy look.

CHAPTER XII

REMOVING VARNISH FROM OLD WORK

REMOVAL by alcohol. Varnish is largely composed of vegetable matter, hence is easily attacked and destroyed by an application of either alcohol or alkali. Alcohol answers well for removing varnish from small objects, but for larger pieces or surfaces its cost and somewhat slow action make it less desirable than other removers. True, it affects the surface of varnish in an instant, as anyone having spilt some on a table-top knows, but that is quite different from eating clear through the old coating. But for removing shellac varnish it is to be preferred.

Alkali Removers.— The simplest of alkali removers may be made from a pound of sal soda to a gallon of water. This may be made stronger if necessary, up to the point of a saturated solution. Apply freely, and while the surface is still wet begin rubbing off with steel wool, brushing out moldings, beads, corners, etc., using a stiff bristle brush. When done, rinse off, using plenty of clean water, to remove the alkali. Follow with a coating of acid water, to neutralize the alkali. Wipe off dry as you can with a dry cloth, and let the job stand until it is perfectly dry. The vinegar or other acid used does not need to be washed off, as it will do no harm. If the wood requires it, from being more or less discolored, and it is not intended to stain it, apply a wash of oxalic acid, to bleach it out. Where it is not expedient to use water you can use benzine instead, which will not make so much slopping around the place.

Ammonia water also may be used, and for some parts, like moldings, etc., is to be preferred to soda or potash, as it evaporates and leaves nothing to injure the finish. It is more or less difficult to clean out corners, etc., and hence the ammonia is best to use. Or if you wish to remove old filler out of the wood there is nothing better than ammonia, using a stiff bristle brush. But it will always be necessary to bleach out the wood with oxalic acid, as previously stated.

Some prefer a mixture composed of ammonia two parts and turpentine one part, which will, with shaking, form a permanent emulsion. Others prefer a mixture of potash and fresh lime, or the lime with soda. These alkalies are very caustic, removing varnish readily.

A powder may be made from caustic soda ⅛, fresh powdered lime ⅜, and whiting ½; keep in dry place, and when wanted for use add water to form a paste like thick cream, which is to be spread on the old varnish and allowed one-half hour to do its work; then it may be scraped off. A pound of this powder to the gallon of water makes a good cleaner for grimed varnish surface.

Fusel Oil.— Removers made on the fusel oil or amyl spirits basis are highly inflammable and also very injurious to the health. They are explosive. Fusel oil forms the basis of ethers, guncotton, collodion, banana liquid, and cheap whiskies. It is a rank poison, and should be handled only by those familiar with it.

Yet it is a sure remover, and may be useful in such matters as cleaning old paint brushes (though some claim it destroys the vitality or spring of hog bristles), or for removing tar, shellac, or copal varnish, lacquer, paint, etc. Here is a sample formula: Mix together 4 oz. benzol, 3 oz. fusel oil, and 1 oz. denatured alcohol. Increase proportions for large quantities.

Here is a similar formula, only it calls for wood alcohol in place of fusel oil; Benzol 3 quarts, wood alcohol 1

quart, and paraffin wax 8 oz. Melt the wax in ½ pint of coal oil, which then add to the other mixture and stir the mass well together. This remover is said to be very good, besides being cheap and easily prepared.

In using such removers the shop should have an abundance of free, fresh air in circulation. Wood alcohol is especially bad on the eyes; we heard of a workman losing his sight in forty-eight hours after working in varnish remover that must certainly have contained a large amount of wood alcohol. Now that grain alcohol, denatured, is so low in price there should be no inducement for using the wood distillate.

Banana Liquid.— Fusel oil gives us amyl acetate, which in turn yields the familiar banana liquid, so called because of its peculiar odor. Amyl acetate is prepared by distilling a mixture of one part fusel oil with one part of concentrated sulphuric acid, and two parts of potassium acetate. The distillate is first washed with water, then with a dilute solution of sodium carbonate, and is finally rectified after being dried over fused calcium chloride. Amyl acetate is insoluble in water, but is miscible in all proportions with alcohol. Banana liquid appears to be a trade secret, but is generally understood to contain soluble and other ingredients in addition to the amyl acetate.

The odor of banana liquid is not pleasant, but it is not harmful to the hands or the bristles of the brush, and it acts well on old varnish. It eats right down through the varnish into the wood, and is difficult to stop short of the wood, once it gets started; hence if only the upper part of the coating is to be removed something less energetic should be used. Yet the liquid will not injure the wood. Alcohol mixed with the banana liquid makes a good remover, leaving the wood in fine condition for refinishing. After the remover has done its work you have merely to rub it off with a rag and benzine.

As banana liquid dries or evaporates very rapidly it is not well to take too large a surface at a time, wetting a small space and removing the stuff as soon as soft; then do another small space, and so on until the surface is done. Another thing to know is, that if the stuff, after softening up ready for removal, is allowed to remain a while it will become hard, and so involve extra work and liquid.

For certain delicate work a workman tells me he uses alcohol to which has been added a little gum camphor, the exact proportions not given. The liquid is rubbed on briskly, and when the stuff has softened it is removed by washing off with soap-suds.

Here is a formula used in making a commercial remover: Pure crystallizable benzine 200 parts, denatured alcohol 200 parts, acetone 50 parts, paraffin wax 25 parts, common yellow rosin 25 parts, carbon disulphide 25 parts, and amyl acetate 5 parts. Dissolve the paraffin wax in the benzine, which is made hot on a water bath, adding the other ingredients afterwards. By omitting the paraffin the remover will be liquid. As such a remover will evaporate rapidly the addition of paraffin wax is preferable, as it holds the remover longer.

The commercial removers are costly, and should be used economically, so as to avoid waste. This is a good way to use them: First coat the surface all over, not in patches, then let it work a little while before trying it to see how it is eating, and if by trying a part it loosens up readily it may all be removed by scraping; but if it does not loosen up readily then apply another coat. The idea is to get the hard coating saturated and softened clear down to the bottom, so that it may easily be removed. To soften up and remove a patch at a time is to waste time and material. Keep the can well corked, as the liquid is very volatile. These are the directions given by a manufacturer of removers. The remover will act

slowly, but it will finally get down to the bottom. On newer varnish or paint (for it removes paint and varnish), it will cut immediately. Where you cannot use a scraper use a wire brush, working the brush back and forth. Or coarse steel wool will do. After removing the old stuff, clean up with a rag and benzine, to which add a little benzol or wood alcohol, to help it cut better.

By the addition of ceresin or wax the evaporation of these volatile liquid removers is retarded, and that is why you find a waxy mass in the can. Shake the mass so as to incorporate this wax with the liquid when applying. By means of a retarder it is now possible to work in the open air with the liquid, or to do upright parts, where the liquid alone would run down and off.

Carbolic acid makes a strong remover, but is entirely superseded now by the removers already noted. The objections against carbolic acid are several: it burns the flesh if allowed to get on it — and it is difficult to use it without more or less of it getting in contact with the hands or face, and its odor is unbearable. Yet it was the principal thing in removers at first. The crude acid was used, combined with commercial glycerine, though in some cases soft soap was added, this, it was claimed, holding up the acid better, by giving body to the liquid. Carbolic acid penetrates the wood too deeply. If you do use the carbolic acid remover, then put on rubber gloves, or oil or grease hands and face.

RUNOVER NOTES.

To remove shellac apply the varnish remover, and when the stuff has become soft take hot water and a small quantity of savogran and wash off with a sponge. Where there are moldings or other difficult parts use steel wool or a scrub brush.

In the case of very ancient varnish coats, where the

gum has lost its liquid binder entirely, it may easily be removed by sandpaper, and this is the very best way to do it, as it is cleanly, and leaves the work in the best of conditions for refinishing.

Varnish that contains much rosin may easily be removed with alcohol or benzol, or alkali. Or perhaps better still, it may be best to scrape it off, or sandpaper it off.

It is found also that in many cases such things as alkali, alcohol or benzol will do the work in hand at a saving. When this can be done it is the part of wisdom to do it. Commercial removers will cost about four times as much as alcohol.

No remover should be used that contains any greasy or fatty substance, which cannot easily be cleaned out of moldings, cracks and carvings. It will also settle in the pores of wood that are not filled. In such a case one cannot bleach out the wood and varnish will not wear well over it.

When removing old varnish from hardwood, do not get down into the filler. To avoid doing so, scrape away the old coating as soon as softened and at once wash up the alcohol with a rag. It is hard to prevent the remover from working on the filler, but it will injure the finish if it remains there. When it does get into the filler, it will be found better to apply more remover and remove all the filler, then refill.

Whenever the workman feels any peculiar sensations in using removers, he should get into the fresh air as quickly as possible. He should watch for symptoms of illness or for any unpleasant or abnormal feeling. Dizziness and nausea often occur when using removers. Some speak of experiencing a prickly sensation. The eyes also smart, and in any case it is best to get fresh air, if only for a few moments at a time.

CHAPTER XIII

VIOLIN VARNISHING

CHARLES READE was not only eminent in the literary world, but he was an acknowledged authority on violins, and here is what he said concerning their varnishing: "Gumlac, which for forty years has been the mainstay of violin makers, must never be used on a violin, not one atom of it. That vile, flinty gum killed varnish at Naples and Piacenza a hundred and forty years ago as it kills varnish now. Old Cremona shunned it, and whoever employs a grain of it commits wilful suicide as a Cremonese varnisher. It will not wear on account of its fragility, it is in every respect the opposite of Cremona gums. Avoid it utterly, or fail hopelessly, as all other varnishers have failed since that fatal gum came in."

Fossil gum amber is the right kind for violin varnishing. It was used by the old violin makers of the 16th and 17th centuries, the varnish being finely colored in various tones or tints, as follows: Golden yellow, golden amber, golden orange, light golden red, deep golden red, dark ruby red, deep blood red, reddish amber, golden brown, reddish brown, and vary dark reddish brown.

The wood is not stained, the varnish is. First the wood is sandpapered smooth and a coat of white or very pale varnish is applied, which is rubbed into the pores of the wood; this is left for a week, when a second coat of this varnish is applied. When this second coat has dried sufficiently it is rubbed down and polished. Then colored varnish is applied, from two to five coats, until the

required depth of color is reached. To do a good job will take about three weeks, and a finer job will take longer. The varnish dries slowly, hence produces a tough finish and is very durable. Where a job must be done in less time a different course will have to be followed, but it is said that the too rapid drying of varnish impairs the tone of the instrument.

To do up an old violin, begin by sandpapering off all the old finish, down to the bare wood. Use at first No. 1 sandpaper, following with No. 00. On a first-class job it will take a day to prepare the instrument for the varnish. It requires infinite patience and care to get the whole surface as it must be in order to preserve its tone after finishing. Those who make a specialty of such work charge pretty well for it, but cheaper work would simply mean poor work, only to be done on a poor instrument, such as the owner might do up himself with a can of store varnish. The prices charged for revarnishing old violins, including scraping off, etc., run all the way from $8.00 to $15.00, according to number of coats, color, and amount of time and labor spent on the work. An extra charge is made on the very costly instruments.

CHAPTER XIV

PREPARING AND USING FLATTING AND OTHER VARNISHES

FLATTING varnish is one of the modern inventions in interior finishing. Its purpose is to give an imitation rubbed finish. Rubbing with pumicestone powder is very costly, as it requires considerable time and the use of skilled labor; whereas, any ordinary painter can apply a coat of flatting varnish, and one coat will answer the purpose. There are several commercial brands of flatting varnish, under trade names which describe the nature of the article, as Flattine, Dulline, etc. Flatting varnish may be prepared by any painter or finisher, from one of the several formulas in use. Here are a few:

1. Dissolve four ounces of shredded wax in one quart of turpentine, which may be cold or warm or the wax may be melted and added to the turpentine, or both may be placed on a water bath. In another vessel place a gallon of hard drying copal varnish, or quick drying rubbing varnish, and place this vessel in another containing hot water, and place both on the back of the stove. When both the wax and varnish are sufficiently heated they may be mixed together and well shaken. After about two days the varnish will be ready for use. It is very important that a perfect mixture of the wax and varnish is obtained in order to get good working and wearing results.

2. Heat on the back of the stove until hot, or heat

on a water bath, always being careful not to let fire get too close to the fluid, one gallon of hard oil finish; shred and add to the varnish six ounces of beeswax and stir the mass well. Then stir in two ounces of sweet oil, following this with three pints of turpentine, which will give about two gallons of flatting varnish. While still warm filter or strain through cheesecloth into varnish cans, and leave the cans open until the varnish becomes cool. The sweet oil is added for the purpose of retarding the setting of the varnish, which may be too rapid for good spreading. As some may object to the use of a non-drying oil in the varnish, there may be added, to offset the action of the oil as to its effects in making the varnish too soft, a tablespoonful of gold size japan to the gallon of varnish, if hard oil has been used, or double quantity of gold size if exterior varnish has been used. For windows use a good grade exterior varnish.

3. This is a factory formula, which the workman can scarcely hope to prepare, but from it his knowledge of the subject will be enlarged. Saponify 10 gals. China wood oil by boiling in an ordinary varnish kettle with 11 gals. of water in which is dissolved 8 lbs. of sal soda and 1 lb. granulated caustic soda. In another vessel dissolve 20 lbs. alum in 20 gals. water, to be used later on. When the oil shows complete saponification and drops heavily from the stirrer, add 22 lbs. pale rosin, pulverized, so that it will melt quicker. As soon as the rosin is melted and thoroughly incorporated with the soap, add the alum solution, which will cause the mass to separate on stirring. Let the mass stand over night and then pour off all the water possible, or siphon off with a hose, place kettle again on the fire, and drive off remainder of water by heat. Then dissolve the residue in 70 gallons of turpentine. Mix equal parts by measure of this dilute soap and any Manila or kauri varnish you may wish to dry flat. Of course a rubbing varnish is

most easily flatted in this way, while a slow drying coach or exterior varnish will not suit the purpose.

From the formula given it will be seen that other things may be used in the place of wax, for in this factory article there is no wax of any sort used, yet a flatting varnish is produced. Yet there are other substances also that may be used in the preparation of a flatting varnish, such as China clay and glue. Glue is cheaper than beeswax. Japan wax also may be used. Or the dull effect may be produced by means of alkali, which some manufacturers employ, as in the formula given. Such a varnish would not give good service; it would be a sort of emulsion. Some add coal oil or kerosene oil to the varnish, saying that it gives the desired dull effect and a very uniform surface, but it is probable that such a varnish would give very unsatisfactory wear. Others add some linseed oil to genuine beeswax flatting varnish, instead of sweet oil, using two ounces of the linseed oil to the gallon of varnish. The linseed oil serves as a binder, and assists in the spreading of the varnish, making it flow better, leaving no brush marks or laps. But there is danger of the linseed oil and wax separating, instead of binding, while no such objection has ever been urged against sweet oil.

Flatting varnish should be made and applied thin, which will insure a free flow and an even surface. Be careful about laps. Use a badger hair brush, and lay the work off one way, feathering it the opposite way; work the brush quickly, as the varnish sets rapidly. That is why sweet oil is added, to prevent too rapid setting.

Nothing looks worse than a flatted job all streaked and ropy, and real wax flatting will be harder to work than the commercial article, on account of the wax. If too much wax is added the finish will be too soft, and it is well to try the surface to see if this is so.

New work may be filled in the usual way, shellaced,

and given two coats of the varnish. Use clean pots and brushes, and finish parts at a time, to avoid laps.

Flatting varnish is said to have originated with car builders, who desired some finish that would not cost much, and that would simulate hand-rubbed work. The house decorators were not long in perceiving its advantages, yet no high class decorator favors its use, but believes it lowers the tone of the trade, as he puts it. Certainly it is not a durable finish, inside or outside. It does as a makeshift for balusters and other turned parts not easily rubbed, and for that purpose may be used in connection with hand-rubbed work.

VARNISH AND ITS APPLICATION.

There is a varnish made for each kind of work, and a varnish made to fit almost any price. The varnish used should therefore be one that is adapted to the purpose in view; interior varnish for interior work, exterior varnish for exterior work, high-grade varnish for best quality work, and cheap varnish for cheap work. If we try to polish on rubbing, or rub on polishing varnish, or apply inside varnish outside and vice versa, we invite trouble. It is usually best to use the goods of one good varnish maker, rather than use two or more different makes, and this more particularly on the same job.

One of the most frequent troubles with varnish comes from the high pressure rate at which work is turned out in most shops, inferior grades being used, necessitated by the hurry, and often the addition of driers. Then the work may not be in proper condition for receiving the varnish, it may be dusty, dirty, or even greasy. And if the varnishing room is too cold at night the varnish is very apt to creep, which is a frequent trouble. The varnish has had a chill after it was placed in the drying room, which was too cold. The chilling causes an uneven

flow of the fresh varnish. Then the cans of varnish must be handled right; if roughly shaken up pitting may follow. This is due to the fact that the varnish, in the shaking up, has taken in some air or gas in the can, which before was on top, and this is why some varnishers leave a can to stand a while open, after it has been shaken up, as in delivery, etc. This allows the air or gases to escape.

Carelessness or improper methods on the part of the workman may also be responsible for a poor job. For instance, if varnish is applied too heavy the drying is unduly retarded and the finish is apt to present an appearance known as crimping, a sort of ridgy effect. Also the thinning of varnish with turpentine by the workman will injure the gloss. Thinning is sometimes done to make the work easier, but it is wrong, of course.

Some varnish will dry on the surface, and one may conclude that it is dry all through, when it is not. If then another coat is applied, on this undry under coat, there will be varnish trouble. It is safer to allow any varnish plenty of time for drying, say two days, before rubbing or applying another coat.

Varnishing in a cold or damp room is bad, or outside when the weather is not warm and dry. If varnish must be used under such conditions then warm it and keep it warm as you apply it.

Flowing varnish, possessing great elasticity, is the most injured by thinning. In fine cabinet finishing it is often the practice to reduce the first coat of varnish a great deal, thinning with turpentine, so that it will penetrate the wood better, act as binder, seal the pores of the wood, and so make a good foundation for the succeeding coats of varnish. After that coat the varnish is used straight, no thinning, and allowing plenty of time for hardening. If it appears necessary to thin out a varnish first warm the turpentine and varnish in separate vessels, then add

the turpentine a little at a time, shaking well meantime, which will cause a more perfect amalgamation of the two than can be done in the cold state. Varnish should never be thinned on the last coat. The varnish may be cold, or the room cold, then you want more heat, not more turpentine.

Another trouble to be feared in thinning with turpentine is the fact that there is adulterated turpentine, and some of it has been known to contain fifty per cent. of petroleum oil. Such a thinner would cause varnish to dry sticky. We are informed that a furniture maker lost an order of two car loads of furniture through the use of such adulterated turpentine. It would seem that benzine would make a safer thinner than turpentine, for it will not injure the varnish, but will evaporate entirely, and not flat the varnish, as turpentine does to some extent.

Varnish is a very delicate liquid to manipulate, at least this will apply to the better grades, for the finer the varnish the more delicate it is, and the more care is necessary in the handling or application. In its making certain conditions must be met and observed exactly; in its application and subsequent handling there are conditions again, which must be observed. No chance work will do. Varnish will not give the best results unless it has ventilation and fresh air for drying in, and the temperature too must be right, beginning with seventy-two deg., and increasing this up to something over 100 deg. in order that the drying may not be entirely on the outside. Then after all has been done to achieve good results, and no possible cause can be found for any bad results that follow, it is best to interview the maker of that varnish, for he may be able to throw some light on the subject. Sometimes we may see at the bottom of the empty varnish barrel a lot of sediment, and that will indicate that the varnish maker did not filter his goods, as should be done with high-class goods. Filtering would

have removed that sediment. When a varnish has been properly made, prepared, and placed in clean vessels it must of course come forth clean and allow the finisher to do clean work.

PRACTICAL POINTS ON VARNISHING.

The less varnish is worked under the brush the better its luster.

Thin varnish does not bear out well, and if too heavy it will not spread and level up smoothly.

Light bodied varnish will flow out easily and not show brush marks, as heavy bodied varnish often does.

Heavy bodied varnish should not be brushed out much, but be flowed on full, so that it will level up itself.

If your brush is too small for the work, or if you work the varnish too long, expect brush marks.

Use clean brush and pot, clean varnish and clean overalls. See that the surface is clean before beginning to varnish.

Never wet the brush with oil or turpentine while varnishing.

Allow a coat of varnish plenty of time for drying hard.

Use that varnish that was made for that particular purpose.

Often a varnished surface, some hours after varnishing, appears quite dry, and it is, but the surface only may be dry, and the under portion quite soft.

Very deep-pored wood requires a lot of filler, and hence the article of this kind of wood will need to have slower and longer continued drying, in order to dry the filler.

On light colored work it is the practice of some to thin down the varnish, but it would be much better to use a paler varnish, rather than thin down a dark varnish.

If your varnish brush should fall out of your hand, on

to the floor, hold it over a vessel and pour benzine over it, to wash off the dirt. Then put in a clean cup of varnish, work it around in that, then scrape it across a knife into another cup. Repeat until the brush is clean.

Number of Coats of Varnish.— As a general thing too many coats of varnish will tend to cracking, owing to uneven drying, though of course were each coat perfectly hard-dry before applying another coat the liability would be very much less, if not entirely avoided. But we must take the case as it is, for varnish is never given sufficient time to dry hard. The old shop saying was,

> "One coat of varnish never cracks,
> Two coats seldom crack,
> Three coats often crack,
> Four coats always crack."

The character of the job, whether good, fair, or poor, usually determines the number of coats that should be given. If the coats are all of the same varnish cracking is not so liable to follow as where different varnishes are used. It is certainly known that a large number of coats of varnish may be given without any failure of the coats to stand and wear well. Varnishes differ in many ways. Some require as much as seven days to dry, while others will dry inside of twenty-four hours. Perhaps most varnish troubles come from insufficient time allowed for drying.

Varnish to Resist Heat.— Varnish designed to withstand a high degree of heat is made from a gum that melts or discolors at a higher temperature than that which the varnish is subject to. Baking varnish is such an one. Asphaltum is soft, yet it stands a high degree of heat, and is useful for coating automobile parts, etc. The high heat of the baking oven causes it to become very hard and lustrous.

Characteristics of Good Varnish.— It should remain

brilliant after the evaporation of the liquid medium and present a hard, dry surface, instead of a soft, or tarnished surface. It should adhere closely to the surface, and not scale when it becomes dry, even after a long time. Linseed oil varnish should be clear, and show no turbidity or have any solid bodies in suspension. Leaving it at rest fourteen days in a moderately warm place should clarify it, unless it has been adulterated with rosin oil. A very slight amount of sediment may be looked for in the best of varnish, less than ¼ of one per cent. after standing several months; inferior varnish will often show as much as seven per cent., it being imperfectly clarified.

Aged vs. New Varnish.— There is usually more or less doubt about the age of a varnish, and it is well when possible to keep on hand a large supply, so that it can be stored for a time, a year at least. If you buy aged varnish you pay the varnish maker his charges for what it costs him to store it away in tanks, and you can save money by doing this yourself. Get it in drum or barrel, and draw it off so as not to disturb the foots. Old varnish wears better than new, but on cheap work it does not pay to age it, though age would improve its quality.

Effects of Temperature.— Keep your varnish stock in an even temperature, ranging from 65 to 75 deg., as may be convenient. The degree of humidity should be low. 75 deg. is about the best temperature for working varnish in. This temperature makes the application of varnish easy, and induces drying that will be more uniform, drying more from beneath the surface. A high degree of heat has the effect of drying the surface at once, and this protects the under portion from drying. Also, too high a temperature, some advising as much as 110 deg., will cause the undry varnish to flow out and make sags or curtains on work standing in a vertical position. At any

rate, 75 deg. will do no harm, and is not an excessive temperature to work in.

By all means avoid letting varnish become chilled, either in the can or on the job, and it is a good idea to varnish in winter during the morning and mid-day, when the sun is at its best, where one cannot have it as warm as it should be in the shop. This gives the work a chance to partially dry before the colder night air gets at it. As regards exterior varnish in winter, it is again recommended to do it in the forenoon only.

The Making of Varnish.— The varnish gum is fused or melted in a large copper kettle, and when melted the requisite amount of linseed oil, which has been heated to the same degree as the fused gum, is added; the gum and oil then readily unite, but to make sure of a perfect union, so that there will be no danger of the gum separating from the oil, the cooking is continued for some time longer. Then the mass is allowed to cool down, after which it is thinned. The thinner may be turpentine or benzine. If turpentine, then the mass should not be allowed to get much below 300 deg., Fahr. With benzine it may be allowed to become much lower, owing to the very volatile nature of the benzine. If the varnish is not cooked enough it will work freely under the brush, but it will not hold luster nor wear well.

In making pale varnish bleached linseed oil or poppy-seed oil is used. Such oils are prepared by boiling for a certain length of time with one or more of the various salts of the heavy metals, such as lead or manganese, or both in combination, then adding to the melted gum. When the oil and gum have been thoroughly mixed and have obtained the required consistency, the solvents are added, after which the liquid mass is filtered and stored in settling tanks to age.

A varnish carrying 100 lbs. of kauri gum and 25 gals.

of oil will require from 25 to 35 gals. of turpentine as a thinner; the gum will bulk 5 to 9 lbs. to the gallon, according to loss in melting or fusing. The loss in thinning may be estimated at 10 per cent. This, with the loss in varnish bottoms or settlings, in kettle and tank, would result in a product of about 60 gals. of salable varnish, providing 30 gals. of turpentine had been used in the thinning.

Short and Long Oil Varnish.— We divide varnishes into long-oil and short-oil kinds. The first is one that contains the maximum amount of oil, from 20 to 40 gals. to the 100 lbs. of gum. The last may contain from 5 to 15 gals. Furniture varnish, hard-oil finish, and cabinet varnishes are made on the short-oil basis. Rubbing, polishing, architectural and interior varnishes are made on the long-oil basis. Piano varnish has little oil in it, dries very hard, hence takes a very high polish, but is too hard a varnish for ordinary service. For interior work subject to much handling, and where a brilliant gloss is desired a hard gum short-oil varnish may be used. Varnish intended to stand water must contain enough gum to keep the oil from turning white; the addition of wood oil in long-oil varnish will make it waterproof. Railway, carriage body, coach, implement, and other durable varnishes usually contain an excess of oil. For furniture not subject to rough usage a rosin short-oil varnish will answer, but articles receiving hard usage will need a varnish rather long in oil.

As a rule the varnish long in oil will wear better than a short-oil varnish, but its luster will not be as good. A long-oil varnish dries slowly, hardens more thoroughly than a short-oil varnish, and retains its elasticity better.

Some Varnish Notes.— There is no essential difference between coach and cabinet varnishes, they being practically identical in manufacture and materials; it may be added, however, that if anything the former are made

from a better grade of materials and more care is taken in their making. It is quite a common practice to take several brands of cabinet and coach varnish out of the same tank.

Cheaper grades of varnish usually contain Manila copal and rosin. Of recent years, with China oil, the varnish maker has succeeded in producing a very durable varnish with treated rosin. By treating common rosin in a certain way, usually by means of lime, zinc salts, etc., the rosin is hardened and made tougher, and such gum, dissolved in a mixture of linseed oil and wood oil gives a very durable varnish, although one not equal to kauri gum varnish.

The best varnish, viewed from any standpoint, is that made from good copal gum (and of copal there are many varieties), linseed oil, or China wood oil, or both, and turpentine.

Sandarach varnish is used for varnishing the sounding boards of pianos.

The most brilliant varnish is produced with gum mastic, the hardest with gum sandarach, and the toughest with shellac, which also is extremely hard.

Copal varnish varies from a light amber to a dark rich brown, depending chiefly on the condition of the gum. As good varnish may be made from a dark copal gum as from a paler sort, as the color does not influence the quality. If anything, the dark copal is a harder gum.

VARNISH TROUBLES.

Blistering.— Caused by oil or moisture under the varnish. Or by heat acting on undry wood or sap.

Blooming.— Too much driers, or varnish too new, or adulterated oil under varnish, or undercoat not dry, or dampness affecting the undry varnish. Fumes of ammonia, etc., in the air will cause it. Also frost.

Blotching is an aggravated form of pinholing. Cause, oily or damp surface. Or turpentine mixed imperfectly with the varnish. Or improper thinning fluid was used. Bad cases also known as pitting and pocking.

Bubbling.— When the varnish is too warm little bubbles of air form under the brushing, but the trouble is not serious. Cool the varnish to proper temperature.

Brush Marks.— Usually caused by working the varnish under the brush too much; or by using a brush too small for the job. Or by too heavy a varnish.

Brittleness.— Caused by presence of rosin, perhaps benzine also, too little oil, usually a cheap grade, and not fit for anything but the very cheapest work.

Chilling.— Varnish will chill in cold weather in the can, unless kept in a warm room. Should not be used until made warm. The effect of chilled varnish is seen in the sandy or gritty condition of the varnished job. The specks are simply particles of gum, and what is required is to heat the varnish enough to melt these particles and cause them to unite again with the oil, etc. The can may be set on two heated bricks, or on the back of a stove, with stopper out, and when warm fumes begin to come out it may be removed and the stoppers replaced again. Set it away in a warm place for two days, then try it again.

Crimping.— Caused by too heavy a coat, or exposure to sudden change of temperature while in process of drying, or by applying the finishing coat before the under coat was perfectly dry.

Creeping or Crawling.— Same as crimping.

Chipping.— Enameling most affected. Caused by lack of harmony in the different coats of varnish used. Brittle material in the undercoats also a frequent cause. It arises from imperfectly dried undercoat, or from exposure to cold during drying, poor ventilation, varnishing in a cold room, or in a room with a damp floor. Sometimes

called silking, when it occurs in a mild form, or corduroying when in its worst form.

Checking.— Caused by ammonia fumes, coal gas, washing with hot water, or exposure to sudden and violent changes of temperature while drying. Crumbling same thing.

Silking.— In its mildest form known as enameling. The appearance of the work is similar to that of a piece of silk cloth, hence its name. It may come from working in a cold room, or from applying varnish to a very cold surface, or exposure to cold draft of air during drying, undry under-coats, mixing turpentine with the varnish.

Sinking In.— Shows a dead appearance. Various causes. Imperfectly seasoned lumber, undercoat undry, porous undercoat, varnish from a newly opened can, but mostly undry undercoat and poor foundation.

Sweating.— When gloss reappears after the rubbing it is called sweating. Caused by rubbing before the coat is sufficiently dry. Let the coat harden, rub again, and apply following coat promptly. The long-oil varnishes are most liable to sweat.

Seedy.— See chilling.

Sandy.— Surface looks as if fine sand had been scattered over it, something like chilling. Causes, unripe varnish, chilling of varnish by extreme cold, skinning over of the varnish used, before using, dirt or pumice powder, dust, granular particles from dirty varnish brush, chemical change in varnish due to extreme age, and precipitation of gum in varnish by extreme cold.

Sagging.— Varnish has been applied too freely or in too heavy a coat, causing it to flow down "curtains," or "festoons."

Sissing or Cissing.— Same as crawling, which see.

Tears.— Small but heavy runs, mostly about moldings, etc. Uneven application of varnish is the cause.

Turning White.— Due to action of heat or moisture

or both on varnish containing rosin; alcohol also turns such varnish white.

Wrinkling.— Also crinkling. A shriveling up of the varnish coat. Due to unripe varnish, but mostly to unskillful handling of the varnish under the brush.

SUPPLEMENTARY NOTES.

Loss of Brilliancy.— The loss of luster or brilliancy is not always due to an improperly cooked varnish, as we who use varnish know. If varnish is applied over an insufficient foundation it is sure to sink in and of course lose its oil and gum, to a certain extent, leaving a thin coating on surface. A linseed oil varnish, it may be added, will not stand out over a poor surface as well as one containing China wood oil.

Skinning Over of Varnish.— Exposure to the air will result in a skin forming over exposed varnish, and if this skin is not removed completely it will cause a specky appearance on the job. Better strain the varnish through fine muslin before using. Exposure to the air for some time will also cause the varnish to become fatty or livered, in which condition it is not fit for use.

The Drying of Varnish.— The expression, "drying from the bottom up," or, "from the top," means the difference between the surface drying of boiled oil and the more uniform drying of raw oil with driers added, as in paint. Taken literally the statement is incorrect, because oxidation or drying must occur at the surface of the varnish or paint, and not at the bottom; but the term, "drying from the bottom up," as I have stated, indicates a certain process that is different from the usual drying of paint or varnish, or oil that is a strong drier or has had driers added to it. What Mr. A. M. Heath, a manufacturer and writer, has said concerning the dry-

ing of oil and paint will apply equally well to the drying of varnish containing oil. He says:

"We have carried through a great many experiments over different surfaces under actual painting conditions, both on new and old surfaces, and watched the penetrating and drying, under different conditions, of both raw and boiled oil. While both dry by oxygen absorption from the outside, the assimilation of oxygen by raw oil is slow and permeates the entire mass which gradually thickens and becomes almost gummy throughout long before it finally surface dries. The observed fact in actual painting that raw oil becomes rather hard and dry at the bottom before it films over on the surface, is no doubt due to the fact that during this long continued gumming, the paint at the bottom has partially dried by absorption into the wood.

"You no doubt have tried experiments along the lines of drying of linseed oils whereby a raw and boiled oil mixed with a pigment if applied by itself on a non-absorbing surface, such as a glass slab, was watched, and it was found that before the raw oil had shown any indications of setting the boiled oil had formed a decided skin or film over the surface, and if this skin was removed from the boiled oil, the under-lying oil was in principally the same condition as when applied to the glass. Watching the raw under the same conditions, you no doubt have found it requires from forty-eight to seventy-two hours before any skin or film is formed on the surface, depending upon drying conditions, that, however, the oil did show, during this time, a tendency to thicken and become tacky. If you ever carried this through on the basis of determining the percentage of oxygen or increase in weight which the oil takes on, you would have found that at the end of forty-eight hours it had commenced to increase in weight, showing

it had absorbed oxygen and that it showed a steady gain until the maximum amount was reached when the oil had become dry, and would then commence to throw off weight and the mass hardens.

"Raw oil watched under these conditions would show that the oxygen is absorbed more uniformly throughout and the thickening is really the oxidizing of the oil, and in place of being entirely a surface-drying, is a drying throughout, and if the skin or film which finally forms over the surface, is lifted or removed, it will be found the remaining oil is much heavier or more thoroughly oxidized than is the oil under the boiled oil film."

Uncorking Varnish Before Using.— It is claimed by some experts that varnish should be opened up to the air, in the can, before using, this in order that any accumulated gases or air may escape. Two or three days should elapse, they say, before using. Experiments seem to bear out this idea. But two or three days would seem to be entirely too long to expose varnish in the can to the air, there being danger of its skinning over. But opening to a few hours' exposure would result in no harm, provided the can was in a place free from dust, etc.

Temperature of Work and Stock Room.— What would be the right temperature for a filling, rubbing, varnishing, and stock room? One varnish room we know of is heated up to ninety deg., and it seems to affect the woodwork, but when the temperature is lower the varnish does not flow right. Much depends upon the varnish and the wood. The varnish may be a rapid drier, suitable to a high temperature, or a slow drier, best suited to a low temperature. If the wood is not perfectly dry it will be affected by extreme heat, causing excessive shrinking. Hence, a low temperature is best for the wood if it is not dry, and of course mostly it is not perfectly dry. But if the wood is perfectly dry then

the high temperature will not affect the same. Filling and rubbing go best in a rather high temperature, yet not too high. The same with varnishing. Most writers on the subject of the drying of varnished stock seem to forget that unless the woodwork is dry extreme temperatures, some advocating 110 deg., will surely shrink it more or less.

Varnish Cracking.— Cracking of varnish may arise from quite a variety of causes, of which we will mention a few. In the first place, the addition of driers for hardening will often cause cracking, especially when the work is exposed to the sunlight. These are distinguished by a silky appearance caused by their extreme fineness and closeness. These may open out much wider later on. Cracks caused in this way are sharp and clean, like a razor edge, and cross the work in all directions. If the driers has been used in any of the under coats, the fact will be indicated by the depth of the crack. Applying a hard, quick-drying coat of varnish on a soft under coat is also liable to produce cracking, which, of course, will affect any coat which is placed upon it. This may also be traced to the application of a glaze coating previous to varnishing, or to a gold size and turps flattening on an oily groundwork. Gold size cracks can be told by their tendency to follow the direction of the brush work, the softer and more rounded edges than in the former case; they are also less numerous and more open in character. The application of a size coat upon a hard, non-porous ground previous to varnishing, such as occurs in cheap jobs, or in re-varnishing, will sometimes be productive of cracks, especially if the size be strong. These are generally in polygon shapes with the edges curling outward.

CHAPTER XV

FINISHING HARD WOOD FLOORS

THE filling and finishing of a hard wood floor differs little from the finishing of hard wood anywhere, whether in furniture or house construction. One particular point, however, is to see that the floor has plenty of time for drying and hardening before it is used. People are so anxious to get into the new house that the floor finisher is not given the time he should have for doing the floors properly.

An oak floor will need to be paste-filled, giving it full and plenty, and allowing about fifteen minutes for setting, then rub off in the usual way, across the grain, using burlap or tow. Let the job then stand about twenty-four hours, then sandpaper smooth, and apply a surfacer, say a thinned copal varnish. Sandpaper again, and for a good job apply two coats of rubbing varnish, rubbing the first coat to remove the gloss, and rubbing the second coat with pumicestone powder and water. Clean up, let dry, then polish with wax. Or with floor varnish if desired.

A close-grained wood, like maple, etc., does not need paste filling. Use shellac or liquid filler, according to character of job and kind of wood; maple is best done with white shellac, and so with any light-colored wood. Georgia pine should be paste filled, to fill the soft parts often met with in that wood, and this filling will make the parts as hard as the rest. When dry and rubbed down, apply two coats of white shellac. Such a floor

should be rubbed once or twice a month with polishing oil, to keep it in fine condition. In another part of this work we give formulas for revivers or renovators. Crude petroleum is a very good one.

A good dull floor finish may be made by dissolving one pound of wax in a quart of crude oil, applied with a bristle brush. It is well to have a can of this on hand, for touching up worn or bare spots.

For a waxed floor, varnish makes the best foundation. Some finishers think waxing on the bare wood the best way, giving two coats of wax, but a filled wood will give better wearing results.

As wax is easily affected by water, to preserve it from such agency apply a thin coating of a varnish made from best copal varnish 6 parts, boiled oil 6 parts, and turpentine 10 parts, well mixed together. Observe that the coating must be very thin. It will preserve the flat effect of the wax, having the characteristic dull luster.

Hard maple floors should have two or three thin coats of pale shellac varnish, each coat rubbed down well with sandpaper, the first coat very thin.

Some hard wood floors may be given a coat of raw oil with a little japan drier and a very little turpentine. When dry, fill in the usual way with paste filler, filling the cracks with paste filler made stiffer with silica and colored to match wood. Finish with shellac, and sandpaper smooth, following with rubbing with powdered pumicestone and oil.

Never apply oil to a maple floor, as the oil will darken the wood, unless darkening is not undesirable.

A hard pine floor may be shellaced, then waxed and polished. Or just two coats of wax on the bare wood, the last coat to be rubbed to a polish. Some have had good results by first applying a thin coating of raw oil, well rubbed in, and in about a half hour shellac.

If a floor has to be done for quick use, color some

orange shellac varnish with an earth pigment, thin up with alcohol, and give two coats, an hour between coats. By doing the work the evening before the floor will be hard enough to use the next morning.

A painter says he takes a new hard wood floor and paste fills it, then when it is dry and rubbed off he gives it a coat of raw oil with a little japan in it, rubbing this well, and then lets the job harden. Then he applies a coat of thin shellac.

The very first thing to do with any new wooden floor that is to be "finished" is to get it perfectly smooth and clean, just as one would do with furniture.

A soft wood floor is best finished with a varnish, and the wood may be stained if desired, this being done on the bare wood. Of course, either varnish, shellac or wax may be employed as a finish.

A cheap finish, and one that will at first have all the appearance of a strictly first-class job, may be done this way. Oil first, fill with some cheap filler, paste filler preferred, apply a coat of shellac, one of varnish, rub off lightly, then polish with wax.

Wax is not intended for hard service, but for beauty. Nor is it to be commended for an undercoating for varnish, as it will not wear well. A good floor varnish, properly applied, thinned down well for each coat, is about the best finish outside of a hard paint. With care a varnished floor will retain luster and wear well for a term of years. One painter mentions a floor in a home where a family of average size was reared, that was varnished and lasted for twenty-seven years, looking well then. It was frequently cleaned off with milk.

Objection is often made against a wax floor finish that it makes a dangerously slippery surface, but this can be avoided to a great extent by the manner of treatment. After the floor has been properly filled, carry it through with wax to the finish, without any shellac or

varnish. Or if shellac be used, then apply only a very thin coat, and sandpaper it down well before waxing.

It is not advised to use a wax finish for floors of bath rooms, entrance halls or kitchens. Wax finish is desirable for residence apartment floors.

Parquetry floors are usually finished with shellac. It maintains the light color of the wood, and prevents any oil or wax from darkening the wood, when applied afterwards.

Varnished floors are desirable for hospitals and like places, because hard and easily wiped up. If wiped up occasionally with milk, and care taken as with a piece of furniture, a varnished floor will wear well for years.

Floors of office buildings, stores and other public buildings, where subject to hard and constant use, may best be treated with a non-drying oil, floor oil. Neither varnish nor shellac would last long on such a floor. Very satisfactory results may be had by paste-filling or liquid-filling the wood, then rubbing it off. If that be not necessary, then apply a coat of raw oil with some japan in it, and finish with a liquid wax polish. Such floors may be washed without injury. They will not spot white, as hard floor wax will, and are easily cared for and renewed. This method has been in successful use in some large department stores, office buildings, public dining rooms, and private kitchens, etc.

At a summer resort on the New England coast, some floors of rift Southern pine, on piazzas of hotels and cottages, were treated with kerosene oil, after cleaning them off, and while the oil apparently sinks away, yet it seems to preserve the wood, looked and wore even, and did not show footmarks.

A wax finish containing only beeswax and thinners will be soft and require renewal often, as compared with one composed of beeswax to which has been added a

certain proportion of paraffin, which will make the wax slightly harder; it is easier also to polish.

A new floor when waxed should be left over night before polishing, but an old floor may be polished as soon as the wax has been brushed over it. This may be done with a woolen rag, but the weighted brush is better. There are floors in France that are waxed and so highly polished that they reflect the furniture standing on them, and have been in use for 200 years; nothing but beeswax has ever been used.

Never use water, benzine or naphtha on a waxed floor; use only turpentine as a thinner or washing-off fluid.

Speaking of the wearing power of wax finish, an old grainer said that many years ago, in New York, the best houses had the front door grained, and that varnish was hardly ever used for the protective coating, but that wax, with a little varnish in it was used. He thought this method of coating gave the work a more natural woody appearance than varnish did, and he declared that wax gave better wear than the best exterior varnish did.

In olden times floors were first oiled, then waxed, the result of which was that the wood darkened. They used beeswax dissolved in turpentine. Methods for finishing woods have greatly changed. Then the wood was finished to preserve its natural color, with wax or varnish. Now an endless variety of stains is used.

A finisher says he once did a fine oak floor, sand-papering it until it shone with a luster equal to polish, using no oil on it. Then he waxed it. This gave a very fine, durable job, but was too costly.

Cold raw linseed oil for a hard maple porch floor, well rubbed in, has been found to wear well. A mixture of two quarts of raw oil and same of turpentine, and one pound of beeswax, melted with the liquids rubbed into the floor, makes a good finish, but must be repeated at least once a year.

FINISHING A PINE FLOOR.

Varnish does not usually wear well on a hard pine floor. Hard pine, or yellow pine, as it is often called, is very generally finished natural — that is, without any stain. The wood is first given a coat of liquid filler, white shellac or linseed oil, and is then varnished. Or, instead of being varnished, it is given another coat of white shellac or is waxed.

Now, if floors are made to look on and not walk on, this would suit the tastes of many, but as floors are intended to be walked on, it is, I believe, not a success. Unless the floor is most carefully protected it will soon wear off in spots, and will look black and disfigured. The casters will plow tracks in the soft wood, and the beauty of the finish is soon effaced. Probably every one of us has at times stood disconsolate before one of these disfigured varnished pine floors, and has been undecided as to what was best to do. It is my conviction that a pine floor should never be varnished, and hardly ever shellaced. It should first be stained rather dark with an oil stain, and when thoroughly dry it should be given a coat of oil and turpentine, equal parts, and wiped dry. First wipe it across the grain with an oily cloth, so as to wipe the oil from the harder into the softer parts of the wood, and finally wipe it absolutely dry with a dry cloth. This should be repeated until the wood will absorb no more oil. When a floor is finished in this way, it will not scratch or wear off in spots. It can be revived at any time, and may be used immediately afterwards.

The more a pine floor that is treated as above is worn the oilier and better it will look. It is not slippery, but gives a good hold to the foot, a matter of great importance. In time it acquires a deep brown color, gives re-

pose to the eye, comfort to the foot, and forms a proper ground for the other accessories in the room.

As there is some difference of opinion respecting the use of a filler on woods before waxing it may be explained here that one purpose of such filling, say where shellac has been applied, with wax over it, when you wish to clean up and renew the finish, it is easy to remove the wax with turpentine, whereas, if the wax is on the bare wood, as advocated by some, a less uniform and clean result will be achieved. Where wax is washed off to the shellac foundation you have just as good a surface for the new coating of wax as when the floor was new.

To prevent grease spots from injuring the floor, apply a mixture of equal parts of raw oil and turpentine, with a little japan, which will keep the oil from combining with the wax.

For parquetry floors the best treatment is to apply, in succession, three coats of white shellac varnish, allowing each coat to dry hard, but they can also be waxed without any other treatment.

The floors of the Lyons (France) hospitals are coated with paraffin thinned with petroleum, and applied quite thin.

Some advise three coats of thin shellac for hard wood floor, sandpapering each coat lightly with fine paper, then a coat of wax, containing a little japan; rub to a polish with weighted brush.

Another way is to paste-fill the wood, then apply two or three coats of shellac, sandpapering each coat lightly, and apply two coats of a good elastic or spar varnish. Allow each coat of varnish to dry thoroughly, sandpaper the first coat lightly to dull the gloss, then finish with wax.

A method for some floors is the following: Apply a coat of good japan, made very thin with turpentine, let

it dry, then rub lightly with fine paper, apply another coat, let it dry, then finish with one good coat of varnish. This finish is said to wear well. Wax instead of varnish may be used if preferred.

Some kinds of flooring may be coated with hot linseed oil, well rubbed into the wood, and then wiped off; in two days give another coat. Then polish by hard rubbing. A painter who has used this formula for years says the wood does not turn brown, though it will darken some in time.

A method used by another finisher calls for a mixture of shellac thinned with alcohol and some good elastic carriage varnish, all well shaken together, then adding some good hard oil finish. Several coats of this are applied and each coat rubbed.

A mixture of raw oil and turpentine, half and half, well rubbed into a paste-filled floor, and rubbed frequently will give a fine surface.

A prominent contracting painter says:

"A general principle can safely be laid down, which is, to produce the finish in as few coats as possible. A hardwood floor of quartered oak or other porous wood, should first be filled with a good paste filler. Beware of liquid fillers. Many of them are emulsions that can readily be dissolved by the use of hot water, and their action on the subsequent coatings of varnish is disastrous. After the paste filler is dry and hard, the floor may be finished in either shellac, varnish, or wax. Some painters prefer to give the floor two thin coats of shellac and let it severely alone. Others prefer two or more coats of good varnish made especially for the floors. Still others, and they seem to be in the majority, recommend a wax finish, in some cases applied directly to the floor over the filler, but generally used after a thin coat of shellac has been applied over the paste filler. The prepared wax is applied with a brush and polished by the use of a weighted

brush. Beeswax alone is a rather soft substance for this purpose. The prepared waxes contain harder ingredients, and make a more polished finish.

The results of any of these methods for wearing quality will largely depend upon good workmanship and the use of the best materials. It often happens that a job will turn out poorly after the painter has done his best and when his conscience is perfectly clear, knowing that he has used nothing but the best of materials, applied by skilled workmen.

Frequently, after the lapse of a short time, the master painter is called upon to look at some of the floors he has finished, and their appearance may justify criticism. This happens most frequently on a refinished floor. A new floor rarely turns out badly, unless a cheap floor varnish has been used. The master painter is at a loss to understand the cause of the trouble. He discusses with himself whether it is the shellac or varnish. The work was well done, the materials well recommended, yet the result is unsatisfactory, both to owner and himself. He must assume the blame, and attempt to correct the trouble, often at considerable expense to himself and without guarantee that the same thing will not happen again. In such cases it is my opinion that the fault frequently lies in the materials used. The master painter has to suffer the consequences and the manufacturer or dealer is not considered by our customers, who place the responsibility wholly with the master painter. I was called into court last summer as an expert witness to give testimony on a painting job in dispute in a new building. All interior standing finish was done in varnish, also certain floors throughout the building. I testified that the interior was done with a very poor quality of materials, especially upon the floors. The whole looked very badly. A local varnish manufacturer, who supplied the goods, was called as a witness to testify to

the quality of his varnish. When put upon the stand on oath, he was asked by the Judge, "What is the difference between a floor varnish and any other?" His answer was: "There is no difference. They are all alike, except the label, as we see fit to mark our goods." I do not claim that reputable manufacturers are so unscrupulous as that, for I have found excellent results from so-called floor varnishes which are made especially for that purpose, and would recommend them.

Now, what could we advise for a durable finish for a hardwood floor? Shellac is good, varnish made for that purpose is the same. One may be better than the other to suit different conditions. Wax I will put in a class by itself, as there is not so much chance for inferior quality. Many shellacs in the market are not good enough to be used upon floors. Some varnishes that are not specially made for such work are not good. That being the case, it is up to the painter, if he intends to be honest, to pay for the proper material, and when he gets it to stand by it.

Now it might be well to mention the master painter who means to do good work, and at the same time cheapen the cost on account of a low price for his contract. Instead of using a paste filler, he will substitute a liquid filler, which by all means should be condemned, especially upon floors. He may use shellac at a cost of $1.10 per gallon, and varnish at about the same price. Is it consistent to expect to obtain good results from such low-priced material? Such a grade of goods used upon floors should be condemned, not only by the painter but by the public. The sooner they are educated to pay the price for good work the better, for they will find it is economy in the end.

Now, to get down to the subject,— the best treatment of floors for durability. As I have said, a great deal depends upon workmanship and the best grade of mate-

rial. In my experience, I consider the less body of material upon the floor the more wearing quality it will possess. Wax having the least, consider it preferable to either shellac or varnish. For a hardwood floor shellac will come next, having less body than varnish. I would avoid using shellac for an undercoating for varnish, as much as I would varnish under shellac finish. But unfortunately, as much as we wish to produce the best results, the limit of time required to finish a floor entirely in varnish would, in many cases, be out of the question. Wax, on the other hand, can be used and finished more quickly than any other treatment, and when properly done makes a more beautiful surface than either shellac or varnish, and is more easily kept in condition, provided the work is brought up properly. Floors require a great deal of attention to keep them in proper condition. The public expect floors when done to last for years, without giving them any care, and the painter is blamed for poor wearing qualities. They forget that iron, marble, or wood will wear down. That being the case, what can be expected from a shellac or varnish?

POLISHING HARD WOOD FLOORS.

With a growing tendency toward the adoption of hard wood floors for public buildings, hospitals, show-rooms, dancing rooms, and the large rooms of many private houses — either in the form of maple or oak boards four inches wide, tongue-grooved and secret nailed, or the familiar block flooring as used in schools and many public institutions, floors that show up to the best advantage if frequently polished instead of being cleansed with water — there has been quite a number of machines invented for the purpose of imparting a polish; one such in size and shape closely resembling a lawn mower with a revolving brush at the front to distribute the waxing solution as

it drips from a vessel immediately above, followed up by a series of reciprocating brushes to impart a gloss; and another of two hinged boards arranged in the form of a triangle and worked over the floor — to and fro — by means of a long handle — provision being made for clipping polishing cloths on both boards enables one side to be used for distributing purposes and the other for drying off and imparting a final gloss.

The first polishing of floors is often considered a laborious task that can be done by any unskilled labor, which is a great mistake. This class of work is generally undertaken by those who French polish shop fittings, who, owing to the cost of appliances made specially for the purpose, ofttimes make a fairly satisfactory job by the experiment of screwing a number of scrub brushes on the underside of a strong box which can be weighted with bricks and pushed or pulled along the floor.

It occasionally happens that firms that undertake the painting and decorating of rooms with hard wood floors may be asked to undertake the finishing or renovating of the floors as well.

In the event of its being built up of the old style of floor boards, the shrinkage of the boards, with the inherent open joints and nails showing, does not tend to enhance the appearance of a well polished floor, these defects should be corrected by the insertion of wedge-shaped slips of similar wood, and the nails punched in so that they can be hidden with putty.

If such a floor has to be undertaken, or even a hard wood floor that has become dirty through long neglect, a thorough cleansing is half the battle toward success. This is best accomplished with a strong solution of washing soda, when dry brush over with linseed oil, or equal parts of oil and turps, then sprinkle freely with dry sawdust, to be brushed well about to dry up the moisture; this, if afterwards scrubbed over the floor with a

weighted brush, has the effect of scouring down any apparent roughness and imparting a slight gloss.

When the floor is freed from the sawdust, it is afterwards wax polished. If a first class job is desired pumice powder or steel wool is used instead of sawdust, especially on hard woods.

As already explained, the weighted box arrangements offer a useful idea when the floor is only intended to be done once, in order to leave it as clean as it was found when decoration was commenced, or for the purpose of cleansing an otherwise dirty floor. Even with this trouble there are times when by reason of unsightly stains showing through, some bleaching preparations may be required to gain a perfectly clean surface. For this purpose dissolve 1 lb. oxalic acid in 1½ gallons of hot water and brush the solution over the affected parts. If the stains are not very deep, the effect is ofttimes magical. If not effective repeat several times; in obstinate cases try the effect of a strong solution of chloride of lime, followed up with oxalic. The general result of these bleaches is to cause a clean patch that shows up much lighter in color than the rest of the floor and may bring about the advisability of bleaching the whole of the floor. In this case the acid need not be used so strong. In all cases when bleaching has been adopted its further action should be killed before applying oil or wax by means of a liberal application of common vinegar. Neglect of this precaution ofttimes results in the acid that lingers in the open grain eating the waxing preparation away, or causing white patches to show up in a few weeks' time.

Where it is desired that the floor should be periodically polished and kept in good order, the initial cost of the provision of brushes and accessories made especially for the purpose of floor polishing will be amply justified in the case, and simplicity of working, and a satisfactory

finish, either direct from the bare wood or the subsequent keeping of floors in good condition afterwards with a minimum of trouble.

FORMULAS FOR FLOOR WAXES.

1. A mixture composed of 2-3 melted beeswax and 1-3 turpentine.

2. Shave quite fine 4 oz. each of spermaceti and paraffin wax and add 8 oz. talcum powder. Work together and pass through a No. 10 sieve. Makes dry wax compound for dance floors.

3. Powder 20 oz. stearin, 5 oz. yellow beeswax, and 2 oz. soap. Mix and sift together. For floor sprinkling.

4. Yellow beeswax 2 lbs., raw linseed oil 1 pint, and turpentine 1 quart. Melt the oil and wax and add the turpentine later. It should be about the consistency of butter.

5. Shave fine 1 lb. of white beeswax and boil with 1 oz. of pearlash in 1 quart of water. Stir until the wax melts and unites with the water.

6. Dissolve ½ lb. potash in 3 pints of water in a saucepan, on the stove. When the water comes to a boil throw in 1 lb. of finely shredded beeswax. Stir well until the wax has melted. Let it become cool. If too thick, add more water. Apply with a paint brush, same as paint, with the grain of the flooring, and when dry rub with heavy brush.

7. An English method calls for a small quantity of spermaceti melted in a pan on the fire, and when melted take from fire and add turpentine until the mass is quite fluid. Use polish in the usual way, by rubbing, in this case with flannel.

8. This is a good cheap wax floor: Dissolve ¼ lb. of potash in 1 gal. of soft water, then place a pot on the fire and in it place ½ lb. yellow beeswax, cut fine, add

½ pint of the potash solution, then let the mass melt together on a slow fire. When perfectly united add the rest of the potash solution, let the pot remain on the fire and stir contents all the time. In course of time the mass will look like curdled milk, then add more water. When wanted for use warm it.

9. To make a powdered wax for dancing floor, melt in 63 deg. benzine as much paraffin wax as the liquid will take up, then stir in talcum powder to form a fairly stiff paste. Rub through a No. 10 wire sieve, then spread out thinly on trays, to let the benzine evaporate. When the mass has become perfectly dry pulverize, place in tin cans with perforated tops, and use by sprinkling on the floor.

10. A cheap floor wax may be made from ceresine wax or purified ozokerite dissolved in kerosene oil on a water bath or on a hot stove plate, but never on or very near a fire.

POINTERS ON FLOOR WAXING.

A waxed and polished floor is slippery, but if desired, when a floor is to be danced on, the wax may be removed and when the dance is done the floor may be re-waxed. The advantage of a waxed floor is in the fact that it can so easily be restored. It may be made new every day.

It is extremely difficult to shred or cut beeswax with a knife, but if you will heat the knife there will be no trouble whatever. Place the knife for a moment in hot water, but wipe it dry before using to cut the wax.

The addition of from 10 to 20 parts of rosin will make the wax harder. Some of the harder waxes, Carnauba or Japan, will also make it harder. Paraffin wax alone is too brittle for a floor wax, though it is sometimes added in some proportion, particularly the store goods.

It does not work soft, like beeswax, but is short and crumbly.

Floor wax may be colored, annotta being one good coloring agent. Color according to wood that is to be waxed.

Care should be observed in applying wax to a floor not to get too much on the surface, for it is soft and will show footprints. After applying the wax let it stand an hour or so, to let the turpentine evaporate. Rub to a polish with weighted brush, a 14-pound brush or one of less weight will do. After rubbing with the weighted brush polish further with same with old carpet fastened over it. Let the job then stand until next day, then rub again with the carpet-covered brush.

Don't forget that the wax may be hardened and made to dry quicker by the addition of a little japan driers.

The secret of success with wax lies in applying it thin and rubbing it a great deal.

Waxing a floor is not what some think, a cheap process, for labor is 80 per cent. of the cost of any job, and if the waxing is done right it will cost more than varnish.

CRACK FILLERS AND FLOOR PUTTIES.

In some cases, as where the wood is soft, it will be necessary first to apply a light coat of raw linseed oil, allowing this to dry. This has reference to the cracks only, unless it be desirable to oil the entire surface.

Where a water-made filler is used the oil of course may be omitted. Glue size might in some cases be applied before the water-made filler. All cracks should be cleaned of dust or dirt before filling.

Cracks in New Floor.— Make a putty of common glue 2 parts, in 14 parts of water, and stir in 4 parts of plaster of Paris and 2 parts of dry litharge. This glue

is best prepared by soaking it in the water until perfectly soft, then putting the vessel containing it in another vessel containing hot water, then set on the stove until the glue is dissolved. Then the other ingredients may be stirred in.

Large Cracks in Floor.— Newspapers boiled to a pulp, adding wheat flour paste to form a stiff mass, is good. A little plaster in it is an improvement. Or putty made from cottage cheese 5 parts and powdered lime 1 part, mixed to a paste. This sets very hard, and may be colored if desired, but use only the earth colors, as others will be affected by the lime.

Another way is to make the paper pulp and add to it the glue size and calcined magnesia to form a paste. Color if desired. Or, litharge 1 part, plaster of Paris 2 parts, glue 1 part, water 8 parts, cement 4 parts, sawdust 2 parts, casein 5 parts, water 30 parts, ammonia 3 parts, dry lime 3 parts. Soak the glue in the 8 parts water. Add the other dry ingredients and mix with the liquids, the 30 parts water last.

Mix water glass and whiting made into a putty.

To glue size add asbestos powder enough to form a paste.

Mix one part air-slaked and sifted lime with two parts of rye flour, then add boiled oil to form a putty.

Dissolve 4 oz. white glue in ½ gal. of water, by boiling, and when done and allowed to cool to about warm stir in equal parts of fine sawdust and whiting to form a putty.

Floor cracks may be filled with a mixture of whiting putty and coloring, with some varnish and drier to make it dry hard and quick. Paste wood filler makes a good crack filler, and a quick putty made from equal parts of whiting and dry white lead, thinned to a paste with a mixture of equal parts of turpentine, rubbing varnish and coach japan, and colored to match the wood, is good.

Doing a Large Dormitory Floor.— A painter had a large new school building to do, with a dormitory floor and others comprising in all about 20,000 square feet of yellow pine flooring. The contractor wanted a lusterless hard finish, but neither oil nor shellac was to be thought of. Wax was not mentioned. He wanted a good preservative and no gloss. The only thing in sight in such a case seems to be a good floor varnish rubbed off with curled hair, or rubbed down with water and pumice stone powder. Two coats were all that was to be given. We would apply one coat to the bare wood, let it have two days to dry in, then apply the second coat, and rub off the gloss, as suggested.

Doing a Georgia Pine Floor.— Georgia pine does well waxed, applying the wax to the bare wood and applying two coats. Such a floor must, however, be rubbed occasionally. Boiled linseed oil applied hot is good for a hard pine kitchen floor, but should be rubbed with oil at least once a month.

A varnished floor will last much longer and look better when occasionally rubbed with linseed oil, which restores to the varnish the oil it loses from wear.

Shellaced Floors.— When it is desired to keep the natural light color of a wood from darkening the use of white shellac is indicated. Shellac makes a nice finish, and is easily kept in condition by rubbing with kerosene oil to remove dirt and brighten it. Or linseed oil will do, if care is taken to wipe off all surplus oil.

Dancing Floors.— Here the wear is heavy, but for that reason wax is best, for it is easily restored. Rubbed over with oil once in a while it looks very nice. When the wood is close grained it may be filled with wax and a second coat will give the finish. This will preserve the color of any light wood.

Bath Room Floor.— Here the floor is subject to water and alkali. The wood may be any of the hard or close-

grained woods used for floors. A prime coat of shellac may be given, then two coats of best floor varnish, rubbing the first coat with curled hair to remove the gloss. The finishing coat may be gloss, or rubbed with water and pumice stone powder. Allow plenty of time between the two coats of varnish.

Formula for Making Floor Oil.— Mix together equal parts of neat's-foot oil, cottonseed oil and golden machinery oil, useful for floors of large public buildings, department stores, kitchen floors, etc. A cheaper oil, known as dustless oil dressing, is crude petroleum.

PUTTIES AND CEMENTS FOR HARD WOODS

A very hard cement for filling defects in wood can be made by melting one ounce of common rosin and one ounce of yellow beeswax in an iron pan, and when perfectly melted stir in one ounce of Venetian red or other earth pigment, according to color of wood, until of the right consistency. This filler must be used while it is hot, for it becomes like stone when cold, adhering firmly.

Dissolve one part of the best cabinet glue in 16 parts of hot water, and when dissolved and cool, stir in hardwood sawdust of the desired kind or color and some whiting until like putty.

Make a putty of fresh slaked lime one part, rye flour two parts, and raw linseed oil enough to make it into putty. Color to suit the work in hand, or use varnish instead of oil. Add together equal parts of red lead, white lead, litharge and chalk, all dry, and mix into a paste with linseed oil.

Cabinetmaker's stopping for wood is called beaumantique. It is made as follows: Put 1 tablespoonful of shellac, 1 teaspoonful of pulverized rosin, a lump of beeswax the size of a walnut, all into a cup or iron pot. Set this vessel on the stove and allow the centents to

melt. For use on mahogany add a little Venetian red, to match the wood. For oak add a little yellow ochre or raw sienna, with a little umber or black for a darker oak. For ebony or rosewood add a little lampblack. Mix the mass well together.

The stopping may be used in the liquid state, or it can be made into sticks like sealing wax, by pouring it onto a board and rolling it out like dough. This is the better way, and by having a variety of colors it is always at hand for immediate use. When wanted for use, it may be heated with a candle and run into the place it is intended for. Level it off with a chisel and make smooth with very fine sandpaper.

If you have occasion to stop nails or other holes in hardwood, defer it until you have the second coat of shellac or varnish on. At least do it after there has been enough finish applied to bring out the true color of the finish, in which event you can match it with the putty. It is advisable to make the putty a little darker than the wood or finish.

To make match-putty for hardwoods, or natural finish, use white lead, because whiting does not give clear colors, which lead does. A good formula is white lead mixed to a stiff paste with boiled oil, staining it to suit.

Formula for Floor Varnish.— A floor varnish that will not scratch or mar white can be made from hard gum only, and all idea of using rosin, even in part, must be abandoned in the beginning. Fuse 100 pounds kauri gum or 50 pounds each of kauri gum and Congo or Sierra Leone copal; when melted with 25 gallons varnish makers' linseed oil that has been boiled in another kettle with 20 pounds of litharge and 4 pounds manganese oxide, and when thoroughly amalgamated take kettle from fire to the thinning room and add gradually under constant agitation 15 gallons of turpentine, or if this be too expensive use 5 gallons turpentine and 10 gallons

deodorized benzine. This will be, when cooled down, of rather heavy consistency, and if so, more turpentine or benzine should be added. To be fit for use the varnish must be filtered, or in lieu of that, strained and well settled.

TREATING OLD OR SOILED FLOORS.

Cleaning Natural Wood Floor.— Strew some white sea sand over the boards together with a solution of potash and water, one pound to the pint. Use a stiff brush, and scrub the way of the grain of the boards. Hot water and good soap also are good under vigorous scrubbing; but change the water often. Oxalic acid, strong vinegar, or nitric acid will remove ink stains.

Coal Oil Stains in Floor.— Apply a strong and hot solution of oxalic acid, then use the scrubbing brush and soap with hot water, changing water often.

Worn Maple Floor.— A floor having had three coats of white shellac varnish begins to show wear. Then renovate it every two or three weeks with a very thin coat of white shellac. Remove stain spots with benzine or turpentine. If very bad, then remove the shellac with varnish remover, after which apply shellac varnish or wax, as desired, for a finish.

Soiled Wax Floor.— The floor has become sticky and streaked with gray from dust. Take a bunch of No. 1 steel wool and dip it into turpentine and rub off the floor carefully, wiping off the old stuff with cotton waste as you remove the wax. Then apply a fresh coat of wax and polish it. It may be necessary to apply two coats this way.

Keeping a Waxed Floor in Good Condition.— Go over the floor once a week with a mixture of equal parts of turpentine, sweet oil and vinegar, using a soft cloth.

Polish after this with a clean soft cloth, which may be wrapped around a floor brush.

Renovating Old Floor.— If the floor has been filled and finished in varnish or wax, the best thing to do is to get all the old stuff off down to the filler, with varnish remover or steel wool, if that is feasible. If you use the remover, be sure to first fill all cracks and crevices with putty, to prevent the remover getting into same and afterwards coming out to injure the finish. Turpentine or benzine will remove wax. Bare places in a fairly good floor may be touched up with shellac.

Discolorations from Soap, Alkali, Etc.— To make such a floor look clean and bright is a difficult problem for the painter. A little savogran in hot water and a little powdered pumicestone under a scrubbing brush is a good thing. All bare spots that have become dark should be bleached out with dilute oxalic acid, and if necessary be touched up with stain and shellac. Oxalic acid 4 oz. to 3 pints water.

Bleaching Old Oiled Floor.— The floor that has been oiled and become dark with time may be treated with varnish remover, after which apply a very strong solution of oxalic acid, or else bleaching powder. The latter is a very unpleasant material to use, not a little dangerous to the health, hence it would be best to try the acid first, for it, while a poison, is perfectly harmless when handled with care.

Re-Varnishing a Floor.— First see that all shoe marks and scratches are removed; try them with oil, and if this hides them you may apply the varnish. But if the oil does not hide the marks then sandpaper them until they are removed. Then varnish.

Renovated Floors Need Cleaning Off.— When a floor has been cared for, cleaned and touched up, year after year, it will become too full of material to wear

good, then it should be cleaned off with varnish remover or steel wool, whichever you think will be best for the job in hand. Clean off down to the wood, and renew as for a new floor.

Cleaned-Off Floor Has Less Durability.—It is seldom likely that a re-cleaned or renovated floor will wear as long or as good as a new floor, due perhaps to the use of remover, a little of which may remain to injure the finish. It is well to use sal soda to clean up after the varnish remover, which will clean off down to the wood and leave a surface fitted for receiving the new coating and finish. But with all care it is hardly possible to remove all traces of removers and acids, and the varnish, shellac or wax is sure to be more or less affected in process of time.

Touching Up Old Varnished Floor.— It is best to touch up the bare spots with quick-drying flat color to match the remainder of floor in color, then give a coat of floor varnish to which color has been added to match the old color of the floor. The color in this case should be ground in japan or varnish, and only enough added to stain the floor varnish.

Caring for the Floor.— Hardwood floors need to be polished about twice a year, and wiped the balance of the time with a soft cloth. Mud stains may be removed with a cloth and water and soap. But be careful to not use too much soap. Be careful when trying to remove stains with gasoline, and if gasoline fails try oxalic acid.

SOME FLOOR NOTES.

Be sure that the floor is scraped perfectly smooth before any finish is applied. And use only the very best of varnish, if the job is to be a good one.

To wax an old but bright varnished floor, rub down

with pulverized pumicestone and water, then clean up and let dry. Then wax and polish in the usual manner.

Before varnishing a pine floor, stop all cracks and crevices with common putty whenever that may be used. If the cracks are very large they will have to be stopped with paper pulp putty, described elsewhere.

To finish white or yellow pine floors with varnish, fill with clear raw linseed oil, with a very little driers added, and finish with two coats of good floor varnish.

A strong decoction of the inside of red-oak bark, set with copperas, makes a nice dye for floors. After rubbing it in well and allowing it to dry, rub the floor with a waxed brush, which will give a polish.

CHAPTER XVI

SAP AND SEASONING

IN no other wood does it require so long a time for the sap to die as in rosewood; in other words, for the albumen to coagulate. If the finisher wondered, as doubtless he often did, why rosewood acted so badly under the finish, he would have found the source of all the trouble he experienced in its slow dying of the sap. This sap acts upon the varnish, and piano-makers particularly have been annoyed by this fact. A preventive has been suggested by some writer as follows: Wash the wood with a weak solution of phosphoric acid and then with alcohol.

This is given, however, merely tentatively, or as a suggestion, for the writer had never tried it. The suggestion is based upon the idea that the phosphoric acid would coagulate the albumen on the surface of the wood immediately, while the alcohol would reduce it to an insoluble state. This is on the same principle as shellacing sap before finishing, thereby destroying the activity of the sap.

Finishers now understand oak better than at first, and usually know why some specimens of this wood act so badly under the finish, while the same kind of wood under other conditions acts well. Oak is full of tannic acid, which is a very active agent. When cut in the growing season it contains much more albumen than when cut in the fall. This will explain the difference between specimens of the same species of oak. The oak is full of albumen, which in the circulation of the sap deposits a

large amount of soft matter on the lining of the wood cells. Of course, if this matter contains any acid it will act upon the filler. This acid acts especially upon starch filling, and many gums, such as are used in some fillers, are affected in the same way, becoming quite soft. The cure is in prevention; have the wood cut at the proper time of year.

That there is a difference even in the same species of woods, say between French and American burl walnut, or Italian and Circassian walnut, is well known to the finisher. There is a difference in the vascular formation of the woods, no doubt, and this must account for the varying results with identical treatments.

The woods we have just named require very different treatments at the hands of the finisher in order to get the most satisfactory results. And the way to succeed with the finishing of woods is to ascertain just what will suit each, this demanding study and experimenting with great patience.

The finisher is advised to employ a microscope for examining the wood structure, for this will reveal to him the real structural character of the wood as mere unaided vision can never do. I have done this in finishing samples, and it is not only very interesting, but instructive and even essential to good work. Take for example an oak panel, and you may find that part of its surface is very coarse of pore, and another part quite close. Now it is reasonable to conclude that the filling necessary for the one part will not answer for the other; the same filler may do, but the filling must be different. In rubbing off the filling we may pull out too much from the coarse, while the finer part will be all right. Again, with the microscope we may see whether the wood is well filled or not. We have seen furniture where the varnish on a part seemed to have sunk in, while on another and near-by part it stood out plump and full. As the work

was done with the same filler and by the same workman, it will be safe to conclude that the difference was owing to the faulty nature of the wood, which fault should have been discovered and treated to make it right.

Staining Ends of Boards.— The end of a board will take up the stain like a sponge, which gives the finisher considerable trouble, the ends showing up much darker than the rest of the work. One way to avoid this trouble is by filling the ends full of paste filler, but the disadvantage here is that if you get on enough of the filler to fill the wood level full it will show the color of the filler, and give an opaque effect, hiding the wood itself. Another plan is to wax the ends, either by placing wax there and heating it in, using a warm iron and spreading the wax over the end, or by rubbing softened wax on to it, using regular wax finish in turpentine. Or cold wax may be spread on with a flexible putty knife, made warm over a lamp. But the smoother the sawed ends are the easier it will be for the workman to finish them nicely.

Shop Economics.— Instead of destroying the life of a filler by excessive thinning, in order to expedite the work, it should be used as heavy as possible, the workman rubbing it in thoroughly. Filler is about the cheapest material found in the finishing room, and the man who puts it on ought to be competent, yet he needs not be a high-priced man. The idea is, to let the lower-priced man do as much of the work in the filling as possible, and thus save the time of a higher priced man who takes it up after the filling. By the observance of things along such lines as this there may be a shop saving effected of fully twenty-five per cent. Labor costs fully eighty per cent. of the entire cost of finishing.

Take care of stock and tools. Keep the paste and liquid materials well covered, free from dust, dirt and air; volatile liquids keep well stoppered, to avoid loss in evaporation. Shellac, varnish, and stain cups

collect dust and specks when left lying around; keep in a closet. Brushes keep in a cabinet or keeper, never allow them to become dry or lousy. There is a good deal of waste permitted with tow in the filling room. After tow has been used a while it may be torn apart when dry shaking out the old filler; or pull apart while wet, then let it dry and shake out the loose filler. Then it may be used again, as good as ever. Sandpaper too, much is wasted that might be used; certain parts of work may be rubbed down with worn paper better than with new.

CHAPTER XVII

STAINING BEFORE USING

THE idea of staining wood before using it holds on so persistently and comes bobbing up from so many different points that it suggests a new era in the finishing room, an era in which the staining process, with all its attending troubles and wrangles, will be eliminated and the work of finishing will be confined to that of smoothing off the work and applying fillers and protecting coatings and polishes.

The latest theory to receive attention in this connection is that of staining wood while it is yet in the tree. This is not a brand new idea; it has been experimented with for quite a number of years, and from time to time there have been announcements of remarkable results by injecting certain chemicals into timber while it is growing or before it is cut down. It has been claimed that one can develop almost any color scheme desired in this way and the idea has been advanced that at some time in the future this will be the process of giving wood its color, and, after being cut and worked, it will be finished natural.

Another idea along the same line consists in injecting stains or coloring matter into blocks and logs of wood after they have been cut. Some wonderful results have been obtained by this process. For example, the color designs of the stars and stripes and other national flags have been forced into timber so that when cut up into blocks the color design makes its appearance on the finished surface of every block. This is a German

process that has been in use for some time, but what it has attained in the way of commercial success in treating cabinet wood is not known. In this country we have as the latest popular idea that of steaming cabinet wood under pressure to harmonize the color and deepen it a little, as well as to hasten the process of seasoning. This is really classed as a method of seasoning, but it does have some bearing on the matter of coloring or staining wood before using. There are some who use practically the same process, and, by injecting certain chemicals and acids into it, bring out certain stains or colors in the wood. Some call this a vulcanizing process, and it is finding favor for preparing oak, mahogany, gum and cherry, and there is a possibility that its use may be extended quite largely in preparing face veneer for use, as it should be practical to give them all a uniform color, and thus not only complete the staining before using the veneer, but make it through and through the wood, so that there will be no possibility of the stained surface working off.

Other ideas and methods will likely be developed. The one thing strongly in evidence is that the idea of staining wood before using is persistent and is likely to prevail. It will do a lot to rid the finishing room of one of the points of contention. Using water and acid stains for veneered work is the cause of trouble with the glue at times and of trouble in the finishing itself, and no one questions that if these can be eliminated it will make the process of finishing easier and more certain as to satisfactory results.

This elimination of trouble in the finishing room is one of the strong arguments in favor of staining veneer and other wood work before using, and there are many others that may be found, such as getting the color uniform through and through. To do this satisfactorily, however, to avoid contrast in color and insure harmony among the different parts of the piece of furniture as-

sembled, it will be necessary to establish certain uniform shades of stains or color for different woods and adhere to them closely. It will not be so easy to ring in all manner of unique variations in stains. This, however, is no real drawback or handicap, for there has been too much of this in the past, and if the cabinet trade will only make up its mind to it, it can get more artistic results from staining wood before it is used, and the finish should be more satisfactory.

CHAPTER XVIII

GENERAL INFORMATION

LIQUID Glue Filler.— A correspondent advises me that he has used the following liquid filler with satisfaction, the work looking well after six years. Melt two pounds of best white glue in two gallons of water, bring it to a boil. Remove from fire and take outdoors, and add with stirring one gallon of gasoline. It is said to do particularly well on close-grained wood. I would suggest the use of benzine in place of gasoline, which is too volatile. And likely turpentine would be better still, though it does not mix with clear water. However, a glue filler may wear well enough where there is absolutely no dampness, not otherwise.

Water Glass Liquid Filler.— The same writer informs me that he has used silicate of soda or water glass on stained wood, which stood well six years, showing up as well as any ordinary stained and varnished work. Such a coating would do fairly well only under dry conditions, and even then I should not look for it to give satisfaction. I am opposed to most cheap finishes of the two sorts mentioned.

Finishing Table Top to Stand Heat.— There is probably nothing better than oil finish. Heat does not seriously affect the oil, and any slight injury done may easily be remedied by rubbing on a little oil. If the wood has never been finished, then rub in boiled oil, allowing a day between coats, and applying several. This is like french-polishing, but not quite the same thing, though

the latter is equally good, only requiring more work and the use of shellac in connection with the oil.

There is perhaps a varnish made that will stand the effects of hot plates, etc. China wood oil is the chief resistant in such a varnish, and it will withstand heat, alcohol, acid, etc.

Adding Perfume to Reviver.— Most furniture polishes and revivers have an unpleasant smell, and to overcome this it is customary to add a little perfume, if we may call it that, though some may think the perfume as bad as the smell it is to disguise. Oil of mirbane is most commonly employed for the purpose, though any other essential oil may serve as well. It is the artificial oil of bitter almonds, and is cheap. Oil of wintergreen is a pleasant smelling one, while such oils as that of origanum, thyme, etc., may be used. There are many pleasant smelling oils that cannot be used excepting in the matter of small quantities of the polish, on account of high cost.

Lemon oil when added to a polish not only imparts its peculiar pleasant odor, but it also acts more or less energetically in cleansing a dirty surface of varnish. Many of the essential oils act in this way. If it is rubbed with a pad on a varnished surface it will dull the surface, similar to the action of curled hair or moss. But it is too costly to use for any such purpose, its price being about a dollar a pound. When used in connection with rubbing oil it saves time to the extent of about one-third. If used in this way the work should afterwards be well cleaned off.

Hard Varnish for Table Tops.— In Germany they add a small amount of ninety-five per cent. grain alcohol to the varnish to harden it, while at the same time it does not impair its elasticity, though it does cause it to finish dim, this effect finally wearing away.

Solubility of Varnish Gums.— The various gums used

in the manufacture of varnish are soluble in oil under heat as follows: Kauri copal, 509 deg. Fahr., Manila, 468 deg. Fahr., North Coast, 548 deg. Fahr., Zanzibar, 156 deg. Fahr., Benguela, 507 deg. Fahr., Sierra Leone, 460 deg. Fahr., Angola, 539 deg. Fahr., Brazilian, 453 deg. Fahr., Damar, 314 deg. Fahr., Mastic, 313 deg. Fahr., asphaltum, 349 deg Fahr.

Covering Capacity of Varnish.— It is estimated that one gallon of shellac varnish will cover 400 square feet, first coat, on smooth pine, and 500 square feet on next coats. Copal varnish will cover 350 to 400 square feet, first coat, 500 square feet second coat, and nearly 600 square feet on third coat. It will cover 50 to 75 square feet more on filled than on unfilled wood.

Oak Without Finish.— One of the latest fads at this writing is to put up trim and general woodwork in rooms without any finish, such as stain or varnish. The raw oak looks well for a time, and may look well for a long time, but is sure to catch dust, also to become stained or soiled in time, hence it would seem better to at least coat it over with a little glycerine in alcohol.

Finishing Outside Hardwood Doors.— Some think the door will stand the weather better if first given a coat of raw linseed oil, rubbing it in well, or the oil can be applied after the filler has been put in. The idea is that the oil will prevent the varnish coats from sinking in, and hence prolong the life and service of the varnish. Use only the best hard-drying coach varnish, for not even the best house varnish will wear as well as this.

Matching Parts of Old Work.— When old work has been repaired so that there is new and old wood together, it is necessary to first stain the new part to agree with the old part. The mineral stains are the easiest to manage for this purpose, but chemicals are the most efficient. Iron sulphate, silver nitrate, and strong acids

all have a darkening effect. Oak may be treated with bichromate of potash with some walnut stain. To lighten any part try oxalic acid. Gamboge, in alcohol, is a good brightener for yellow wood, while alkanet root does for red wood. The root is to be placed in a small bag and steeped eight hours in sweet oil, to extract the coloring. Ebony may be treated with a decoction of gallnuts in which steel or iron filings have been soaked, making what is really an ordinary good writing fluid. Ammonia water will restore the grain of wood.

Matching a Dark Oak.— If required to match old oak with new, try a weak solution of bichromate of potash, say an ounce with five pints of water. A brush will do to apply it with, but a sponge is to be preferred.

Observe that in staining any kind of work we must not allow any part of it to become dry until the adjoining part also is dry, for otherwise there will be double-coating on the laps and darker places in consequence.

Bleaching Wood.— Chloride of lime is a strong bleacher of woods. Here is a formula: Dissolve 17¼ oz. lime chloride and 2 oz. of soda crystals in 10½ pints of water. Wet the wood with this, and see that it remains wet for at least 30 minutes. Then wash it off, and apply a solution of sulphuric acid to neutralize the lime.

Oxalic acid also is a good bleacher, the one commonly used by wood finishers. Some add a little nitric acid or spirits of niter to it. In any case apply the acid hot. When dry, wash off with clear water. Apply the acid with a brush, not a sponge, as the acid should not get onto the hands; it is a poison.

Finishing a Bowling Alley Floor.— Such a floor is subject to very hard usage. The wood is to be filled according to its character. Whether paste or liquid filled, follow with two or more coats of the best hard drying elastic floor varnish, allowing each coat two or even three days for drying. After that time it may be rubbed down

with crude oil and flour pumicestone. Do not rub until the varnish has become perfectly hard-dry, or it will sweat out, and will be to do over again.

Finishing Laboratory Table Top.— Owing to the fact that glass vessels and other breakable things are in constant use on the laboratory table it is not expedient to use marble, slate, glass, or other hard surface, wood alone answering the purpose. But wood becomes badly disfigured in a short time, from the spilling of the different chemicals on it so that it becomes necessary to renovate it frequently, or seek some sort of coating for it that will be immune to the action of chemicals. Such a treatment has been discovered. Here is the formula and method:

Solution No. 1.—	Copper sulphate.....	50 grams
	Potassium chlorate.....	40 grams
	Water, q.s.....	500 c.c.
Solution No. 2.—	Aniline hydrochloride.....	50 grams
	Ammonium chloride.....	40 grams
	Water, q.s.....	500 c.c.
Solution No. 3.—	Potassium bichromate.....	50 grams
	Water, q.s.....	500
Solution No. 4.—	Sodium sulphite.....	80 grams
	Sulphuric acid.....	20 c.c.
	Water, q.s.....	500 c.c.
Solution No. 5.—	Soap suds.	

These solutions are to be applied in the following order: Nos. 1, 2, 1, 2, 3, 4, 3, 4, and 5. But be sure that one coat is perfectly dry before you apply the next coat. This is very important. The liquids are applied with a bristle brush, like a water stain, allowing the wood to absorb all of each coating that it will take up, in order to make the work more effectual and lasting. The soapsuds fix the color, which is intensified by the sulphuric acid. After the soap solution is dry the surface is

rubbed with vaseline, which gives a soft and pleasing finish, besides repelling water. The treatment involves a great deal of hard rubbing and time, but the work is well worth the time and trouble, and the expense, outside of the labor, is small.

The preceding method I have personal knowledge of, the formula having been given to me by a professor of chemistry, and he showed me table tops done in this manner. I also was permitted to see the work under way by some of the students, who prepared the tops and occasionally renovated them, for they needed that too, occasionally. But they looked fine, showing a very handsome dark brown color.

Here is another and similar formula:

The surface of the table top should be treated with a solution of copper sulphate 1 part, potassium chlorate 1 part, dissolved in 8 parts of boiling hot water. Apply this solution and allow it to soak well into the wood. When dry apply a coat of the following solution: Aniline hydrochlorate 3 parts, water 20 parts. Apply two coats of each solution, alternately. When dry, give the surface a full coating of raw linseed oil, rubbing this well into the wood, using a woolen cloth for the purpose, and then remove all surplus oil, rubbing dry. The color in this case will be an ebony black, and the surface may be kept in good condition by washing off at intervals with weak soapsuds, allowing this to dry, then rubbing with linseed oil when dry.

Wax Stained for Colored Woods.— Melt 4 oz. beeswax in 10 oz. of turpentine, color with alkanet root, and strain. Aniline dye may be used also. The wax should be melted in turpentine over a water bath; the alkanet root, if used, should be placed in the turpentine to digest the color, before putting wax in it. The wax should be shredded to facilitate melting. Stir the mixture while melting.

Linseed oil 10 oz., white wax 1 lb., rosin 1 oz., and alkanet root 1 oz. Melt the rosin and add it to the oil, then melt the wax and add it to the oil and rosin mixture; finally stir in the alkanet coloring.

Melt together 4 oz. beeswax and 1 oz. rosin, add 2 oz. turpentine, and Venetian red, dry, to color.

Genuine beeswax is costly, about sixty cents per pound, at this writing. There are other waxes that may be used in place of the beeswax, if desired. Here is a list of waxes with approximate prices, retail, at this date:

Yellow beeswax, 40c. to 50c. White beeswax, 60c. Carnauba wax, 25c. to 40c. Bayberry or myrtle wax, 25c. Yellow ceresin wax, 15c. to 30c. Japan wax, 15c. Refined paraffin wax, 10c. The latter may be bought wholesale at about 4c. a pound. Prepared wax manufacturers use some of these waxes in place of the beeswax, but it must be said that none of them do as well as the latter, being shorter of grain, not so flexible under the brush, etc.

In France there is an artificial wax made, as follows: Melt together 100 parts of parraffin wax, 50 parts clear rosin, and 1 part of Carnauba wax. Then mix 5 parts of talc and enough yellow aniline dye or powdered curcuma to impart the yellow beeswax color; stir the mass until it has become quite cold.

A good exterior wax finish may be made by adding one-half pound of beeswax to the gallon of varnish, using a good exterior varnish; the same wax-varnish may be used inside, substituting interior varnish for the other. To harden the wax-varnish some driers must be added.

In wax-finishing interior hard woods the latter must be filled and varnished before applying the wax. Or the wax may be rubbed into the raw or stained wood, according to kind of finish wanted. On soft woods it is usual to first stain, then apply liquid filler or shellac, then apply wax. The usual proportion of wax to turpentine

is two parts of the former to one part of the latter, first melting the wax, then stirring in the turpentine. Or the wax may be shredded and dissolved in the turpentine, which may be either warm, hot, or cold, in the latter case it requiring more time for dissolution. For a reviver or polisher for furniture more turpentine may be added, say three or four times as much of the turpentine, all proportions to be by weight. To get the egg-shell gloss, rub the waxed finish vigorously with a woolen rag or brush with stiff, short bristles.

A cheap wax polish may be made thus:

Dissolve ¼ lb. of pearlash in 1 quart of boiling water, and while boiling stir in 1½ lbs. shredded beeswax; stir until dissolved, adding water now and then, to make it of the consistency of cream. As it will thicken somewhat upon cooling, add water while using, to keep at uniform fluidity. Apply as you would varnish, and after it has become dry polish with stiff bristle brush or cloth.

By using white wax in the above formula, in place of yellow, the polish will answer for statuary, plaster casts, white marble, etc.

Another cheap polish.— To 1 gallon of boiling water add 4 oz. soap, 1 lb. beeswax, both shredded, and while still boiling add 2 oz. pearlash. Thin with water for use, and use same as preceding polish.

This is particularly recommended for good furniture. Melt one pound of yellow beeswax in one pint of raw linseed oil on a water bath, and after taking it from the bath thin up with a gallon of turpentine. This is a quite thin polish, useful for restoring old furniture. Clean off the furniture, and apply the wax with a soft woolen cloth, after which rub to a polish with a woolen or silk cloth.

To make a restoring piano polish with wax, melt together ¼ oz. Carnauba wax, 2 oz. Japan wax, and 2 oz. yellow beeswax; add enough coal oil to make the mass

about the consistency of vaseline. The waxes are to be melted together first, then are left to cool slightly, when the coal oil is added. Let the mass become quite cold, and then if too solid, melt again and add more coal oil. The Carnauba wax gives a high polish, while the two other waxes temper the composition, making it more flexible.

"I frequently have occasion to visit the finishing department of what is probably the largest factory of hand-made furniture in New York. They do work of the 'good old-fashioned kind,' where quality and not time or price is the first consideration. They think nothing, for instance, of taking eight weeks or so to finish a table. Every piece of their furniture is a work of art, and their entire finishing is done with shellac and shellac only. Sometimes they give their work twenty coats of shellac, allowing twice as much time between the second and third as between the first and second coats, and so on. Of course, the shellac is thinned down to the consistency of milk and applied by pads of cloth. Each coat, when dry, is rubbed dull, so that only the varnish which sinks into the wood is left, and after the final coat the surface has been entirely filled in and has a finish of silk-like smoothness.

"They also shade with shellac; for instance, if a piece of Circassian walnut is lighter at one end than at another they finish the light end with successive coats of shellac until both ends tone exactly, at which time they for the first time begin finishing the entire piece. When work of this kind has been properly done there is no more durable finish known."— *Corresp.*

Chamois Skin.— Yearly the supply of chamois skins grows scarcer, all that can be gathered or made in a year not being sufficient to supply the demand in our country for a single day. Most of the chamois skins are merely the skins of young goats or kids. The skin from the

chamois is heavier than that from the sheep, and also coarser. It is mostly due to the shyness of the chamois and its fleetness that its skins are so scarce. It is only a few months in winter that the animals come down the mountains and are accessible to the hunters, and even then it takes a large number of hunters to meet with any success.

For strength and durability the chamois skin is to be preferred, but for ordinary use the oil-tanned sheep skin does very well, and is much cheaper. The tanning is done in about the same manner as with the chamois skin.

Wash leather, as vehicle varnishers call it, or sheep skin, alias chamois, should not be left in water, but it should be wrung out as dry as possible, spread out smooth, then hung up to dry. Hot water is hard on the skin, making it harsh, destroying its flexibility. A dirty skin may be washed out in water with white soap, rubbing it with a bit of curled hair and soap, first one side, then the other, then thoroughly rinsing it out in clear warm water. Some advise leaving some soap suds in it. This to keep the skin soft, but it is probably not a good way. When dry, rub the skin in the hands to make it soft and pliable. The skin is not to wash off dirt with, but to follow washing with a rag, and to remove any lint that may remain.

The Sponge.— The sponge is an animal, though it does not look like it. Deep water sponges are best. Good sponges come from Nassau and Cuba, but most of the sponges we use come from a reef off the Florida coast. The sponge fishers fill the sponge with sand or salt, to make weight, as sponges are sold by weight. Bleaching injures a sponge, but it makes it look better. Another trick is to pack a certain portion of inferior sponges with the best grade, selling the lot as strictly first-class. No man can tell by looking at a sponge whether it is loaded with sand or other filler or not. The best thing to do in

buying sponges in quantity is to buy from a reliable firm.

Keep sponges in a rather damp place when not in use. This rule applies to single sponge and bale of sponges. A sponge should be used within a year after being taken out of the water. A weak solution of ammonia will clean a dirty sponge and do it no harm. It acts also as a sort of bleach. A strong solution of sal soda will do as well as ammonia, and it may be used without harm.

Pinholing.— Thin filler is a frequent cause of pinholes. Some finishers try to use the filler the same consistency for all woods, regardless of their porous nature. A much heavier filler is required for such woods as oak than for walnut. Unless a filler sufficiently heavy to thoroughly fill the pores is used, pinholes are almost certain to result. As a rule, veneer requires a slightly heavier filler than solid wood of the same kind. For instance, most solid birch, if finished natural, or if not stained with a water stain, may be finished without any filler and without danger of pinholes. Not so with birch veneer. Here a filler must be used, or considerable extra varnish applied to make up for the deficiency. For birch veneer a good pigment surfacer will sometimes take the place of filler; but a good heavy coat is necessary and it must be well brushed in. This is suitable only when the wood is finished without a water stain being used.

Filler that sticks before it gets dry is sure to do bad work and liable to result in pinholes. Sticky filler may be avoided if the finisher will make his own filler, and not make it longer than a week or ten days in advance of using. Nearly all fillers contain japan dryer, and it is this that causes old filler to work hard and tough. Filler should not be used within twenty-four hours after being made, nor made longer than ten days before being used.

Where only a small quantity of filler is used it may be

made up into a very stiff dough or paste without the japan dryer. This paste may be reduced with benzine in quantities as required to suit immediate needs, and the japan added with the benzine. But be sure and use the proper proportion of japan — the same as would have been used had it been put in at the start. Do not guess at the quantity; weigh and measure. Filler made without the japan will keep well for an indefinite length of time.

All filler should be well brushed in, in order that it may reach the bottom of the pore and get a good hold. Unless this is done the air in the pores will prevent it entering, and pinholes will be the result.

Tacky Varnish.— Whatever the cause, whether low grade varnish, or impure atmosphere, apply a coat of fresh lime wash, let it dry, then brush off and apply a coat of good hard-drying varnish. Some use earth pigments like ochre, whiting, or sienna in place of lime, when the latter is not at hand, but the lime does best. In case the pigment is used, let it remain on for several days before brushing off and re-varnishing. Neither whiting nor lime, if any remains on the work, will show when varnished. Some advise a mixture of gold size and turpentine as a size over sticky varnish.

Testing Varnish.— To test varnish for drying hard without thickness try it on a sheet of glass, at a temperature not lower than 53½ deg., Fahr., nor higher than 68 deg., Fahr. At the end of 24 hours partly cover over with a clean cloth wet with clear cold water. Examine after 18 hours. The damp part will show alteration, but the surface should resume its former luster and general appearance in six hours.

A good floor varnish applied to a properly prepared surface of wood or glass should dry dust-free in from 6 to 8 hours at 53½ deg., Fahr., in daylight, ceasing to be tacky at the end of 10 or 12 hours, and quite hard in 24 to 30 hours. It should stand rubbing with the finger

(dry) at the end of 24 hours, and take a smooth polish with pumicestone and water without softening or tearing It should also stand the wet cloth test, and after drying for 24 hours at 53 deg., the varnish should have the same gloss as a similar or same varnish coating applied side by side on the same surface.

Good varnish will work easy under the brush, flow out well, level up perfectly, have good luster, have fullness and not die away, set free from dust in a reasonable length of time, and finally become hard enough to resist a certain amount of friction.

A good test for varnish consists in coating a sheet of glass and when allowed proper time for drying, submerging it in water; if the varnish shows white on its surface it is poor. But it should be remembered that nearly all long-oil varnishes will show white sooner than varnishes containing little oil but much hard gum. The fine carriage finishing varnishes always show mud spotting worse, because long in oil; a short-oil varnish would be better in this case, if varnish is to be subjected to mud, and particularly limestone mud.

The drying of varnish is one of its most important tests. It must in twenty-four hours have dried sufficiently in thin layers on wood, glass or metal, to have a thorough adhesion, and must within the ensuing twenty-four hours have entirely dried away, without, however, losing a certain elasticity and softness. If it dries more quickly no defect is thereby indicated, but if it dries more slowly it is evident that it was not sufficiently boiled, that an insufficient quantity of driers was added during the boiling, or that it contains some foreign substance.

Varnishes should be tested to ascertain their drying properties and their relative durability.

A simple test for brittleness is to allow a drop of the varnish to trickle down a narrow piece of glass. Note the time required to dry, and when dry see if the var-

nish can be removed readily by the thumb nail. If too brittle, it will easily cleave from the glass and in that case is of little value for finishing coats.

Outside varnishes should be tested by application to pieces of hard wood previously filled and should then be placed in an exposed position for at least two years.

Some varnishes seem to have the property of rapidly darkening the surfaces to which they are applied, especially on grained work. It is well to make tests of various kinds of varnish over grained panels and note if this peculiarity exists. It is useless to expect good results unless a fair price is paid for the goods.

In buying varnishes, the price is usually a fair way to determine the quality of the article. When a fairly pale varnish is offered at a low price, it may be reasonable to assume that the article is not made from high-priced gums.

It takes but a short time to find the drying or hardening qualities of varnish, but will take months to obtain a fair idea of their wearing qualities. Varnishes are usually valued by their transparency, gloss, drying and working qualities, but more so for their wearing quality and clearness. To ascertain by comparison the relative value of varnish the color should be considered, the pale ones being of most value, as the darker ones are liable to darken the ground, and in cases such as finishing light natural woods, this is most undesirable. It should work freely and flow out evenly, and after several months' exposure should not crack, powder, chip or rub off.

To ascertain in some measure the quality of the varnish take a large piece of clean glass, drop a little of each of the varnishes to be tried at one end of the glass, side by side, then set the glass in a vertical or inclined position. Then observe carefully the varnishes as they flow down over the surface of the glass

to the lower edge, note the setting and drying of each, also examine the film whether it be wavy or smooth. Smoothness will show the varnish to be well made, while a waviness shows it to be too thick or poorly made. If the varnish dries freely from the edge it indicates that it has been made from good copal gum. If the drip shows a tardiness or a tendency to draw back, it shows the presence of rosin.

Another trial is to apply the different varnishes on a dead flat, black surface; when dry expose to the sun. A varnish containing rosin will, in a few weeks, show by silking and alligatoring.

A good grade of varnish for architectural purposes may be known by these indications: Absence of much color; constancy of consistency; characteristic odor, in which turpentine predominates; ease of flowing under the brush; free flowing or running; will not easily show brush marks; dries rather quickly, though not unduly so; retains its elasticity and suppleness and will never be sticky; stands exposure to the weather and all ordinary wear and tear.

A low-grade varnish dries very quickly, though some kinds will become soft after a time succeeding the drying, remaining soft and sticky indefinitely; dries hard but never is supple and elastic; shows white under water test; scratches under the finger-nail test; difficult to apply, setting quickly, in some cases setting almost as soon as applied; rank odor, benzine predominating; brilliant luster, but subject to cracking badly.

We come across some very light colored copal varnish now and then, and while we know and use "white copal" varnish, that made from the lightest bits of the copal gum, yet we are suspicious of this very light article that seems to get its whiteness from damar. There is a simple test for it: to one part of the varnish add two or three parts of rectified sulphuric ether. If the

mixture remains clear as water, the copal is pure; but if a milky turbidity follows it is adulterated either with gum damar or damar varnish. Which suggests the idea that a few chemicals make up a sort of laboratory for the varnisher that will amply repay him for the cost and time spent upon it.

Testing Turpentine.— There is a good deal of adulterated turpentine and substitutes for the genuine; some made by synthesis, others by admixtures of mineral oils. The varnish maker employs a chemist to try all goods, hence he can easily detect a spurious article. But the varnish user, when he undertakes to thin his varnish with turpentine, as sometimes he will, needs to be careful not to get a substitute or imitation fluid into his pot. It is well to know that the addition of both benzine and turpentine will not do. These two fluids will not mix, and hence will cause trouble when placed in a varnish to thin it. Better use all of one or the other.

By placing a little turpentine in a saucer in the sun you can tell much about its character, for it will, if genuine, evaporate completely in two or three hours at most. By placing some on a sheet of white paper you can also tell, for if pure it will soon evaporate and leave never a stain. Still another easy method is by weighing a sample and comparing it with the standard weight of pure turpentine. Of two suspected samples thus weighed, the lighter will be the better.

China-wood Oil and Formulas.— China-wood oil has been in use for several years, but usually in connection with cheap-grade varnishes, rosin being largely used. Such varnishes are made for furniture, interior work, and for dipping. It is said by those who are assumed to know that china-wood oil cannot be heated by itself to a higher temperature than 450 deg. F. without danger of gelatinizing or becoming a mass of jelly insoluble in all but the costliest liquids. This is said to occur even in

conjunction with other substances, in varnish-making, where more than say 12 lbs. of rosin are used in the making. If more oil is wanted a boiled linseed oil must be employed, one having 3 lbs. of borate of manganese to the 50 gals. of oil, and this may be used in equal proportions with china oil.

The formula for making a durable yet cheap furniture varnish in which china oil figures is as follows: Melt 120 lbs. of rosin to 500 deg. F., and add 4 lbs. of oxide of calcium; then add 12 gals. of china-wood oil, and run the heat up to 600 deg. F., cooling to 350 deg., then adding 6 lbs. of powdered litharge; heat now to 575 deg., and finally cool off to 325 deg. Then thin with 30 gals. of (wine) naphtha.

All I have read about china-wood oil is based upon the use of it without the elimination of the objectionable fatty oil, and which the makers of the varnish say they have succeeded in getting rid of after some eight years of experimenting. The oil used without this treatment will flat upon exposure to the weather, and on this account the varnish is not available for outside work nor for use on agricultural machinery or common vehicles. Manufacturers say that enamels made with it become fatty in the cans. Used in connection with lead paint it causes the paint to liver up or thicken, due to the chemical action of the lead or excess of alkali on the wood oil and rosin.

Brush Preservation.— Once the brush has been put in good varnish and on good work keep it there, and keep it clean. When placed in the keeper have the liquid in which it is kept come well up over the bristles, so that none of the varnish may dry in the butt of the brush. Keep this keeper clean and in a closet. There is a difference of opinion among workmen as to what is the best liquid for keeping a varnish brush in while not in use, but it may be said that most prefer to keep it in the same varnish it has been used in, which seems logical. By

doing this he saves time and labor when taking out the brush for use again. But if he may use it in various varnishes, as occasion may require, then it will hardly matter what kind of varnish he keeps it in. Raw oil is a very good medium for keeping a brush in, but then when you want to use it in varnish it will require a lot of working out to get the oil out, for if any oil remains in the brush it will work out as it is being used and cause great trouble. Some use a mixture of oil and turpentine, which is better than oil alone, but this mixture too will have to be well worked out, or the oil and turpentine will seriously affect your varnishing. One advantage of keeping the brush in oil is in the fact that such a brush will not become lousy, for the oil will keep the butt bristles soft. Unclean varnish brushes do a great deal of harm in the varnishing.

Finally, let it be said that a varnish brush should be kept in a tightly closed tin keeper, with the brush suspended so that its bristles will not touch the bottom of the container, and as to the liquid, that may be whatever you prefer; the only matter is to see that the brush is right before you begin varnishing. If you keep it in oil, turpentine, or a mixture of both, or in a different varnish from that into which you are going to work it, then work the brush out until you have rid it of every vestige of the liquid of the keeper. If you first work it out in turpentine or benzine, then take some of the varnish you are going to work with and in another vessel work it in until the brush is saturated with the same, and every bit of the keeper varnish and cleansing fluid has been worked out, and do not pour back into the can you are using varnish from any of the cleanings, but place these in a separate can, and use it on certain cheap work. None of this material need be wasted.

All new brushes contain more or less dirt, which may be shaken out by beating over the hand or twirling between

the hands. The loose bristles and dirt will then fall out, after which the brush may be worked out in clean turpentine or benzine. After this work the brush in clean varnish, and use it first on cheap work, then it will be fit for the best work.

DESCRIPTIVE LIST OF SOME SUPPLIES.

Sandpaper.—Best flint paper. Sizes, Nos. 00, 1, 2, 2½, 3. Prices, about per quire 18c., 20c., 20c., 22c., 25c.

Pumice Stone, powdered: FFF, or Extra Fine, 3c. lb.; FF, or Extra Fine, 3c. lb.; F or fine, 3c. lb.; No. 0, or Usual, 3c. lb.; No. 1, coarse, 3c. lb.; No. ½, grain, 3c. lb.

Rottenstone, powdered, 8c. lb.

Steel Wool, per pound: No. 0, fine, 40c.; No. 1, medium, 30c.; No. 2, medium coarse, 30c.; No. 3, coarse, 25c.; Shavings, fine 22c.; Shavings, medium, 20c.; Shavings, coarse, 18c.

Rubbing Felt.— In sheets 18 x 18, but may be had cut to any desired size: Hard Mexican, ¼ and ½ inch thick, $1.25 lb.; Soft Mexican, same thickness, $1.25 lb.; Soft Spanish, same thickness, $2.00 lb.

Rubbing Pad.— Rubbing pads ready for use may be bought at 50c. each, there being two well-known pads on the market that should please.

CHAPTER XIX

SHELLAC VARNISH

LAC is a resinous incrustation excreted by a scale insect known as *Tachardia lacca*. The mouth parts of this insect consist of a beak or sucking apparatus combined with a pointed lancet. With this lancet the insect pierces the bark of the twig of a tree, and then inserts a sucking tube and draws up the sap. The insect may be likened to an animated siphon, since the sap, continually sucked up through the beak, is, after modification and absorption of some of its products, given out as an excretion at the anal end of the body. This secretion solidifies in contact with the air, and thus there is gradually formed around the body a scale or cell, popularly known as "lac."

Were only a single insect present on a branch the scale would appear as a circular, dome-shaped, reddish excrescence on the surface of the bark. Owing, however, to the production by the female of a very large number of eggs, often as many as 1,000, and the habit of the insects, which indeed is common to many of the family, of living and feeding gregariously, closely packed together on one twig, the scales or cells coalesce during their formation and result in the production of a continuous incrustation on the twigs, which, on collection, forms the article of commerce known as "stick-lac."

From stick-lac we get the familiar "shellac," or shell-lac. Then there is also button-lac, plate-lac, and seed-lac, all in different forms, from which each variety gets its name.

Natives of India, where the lac is found, strip the trees of the heavily coated twigs and limbs, and place them in hot water, which soon dissolves the resinous matter, freeing insects and bits of wood, and also washing out the coloring matter deposited by the insects. The separated lac is then taken out and dried, and later on is placed in strong bags of coarse cotton. These bags are then held near a fire which, while melting the resin, does not scorch the muslin. The bags are then squeezed and twisted. This treatment forces out the resin in thin films, these being received upon strips of wood. The resin quickly hardens on the strips of wood, and it is then removed by striking on the wood, the lac easily breaking off in the form of thin pieces, something like thin gelatin or glue, the form being well known to users of shellac.

The best grade of shellac is that which is most free from all impurities. As these impurities are dark, it follows that the best shellac is of the lightest color. It is a light orange or brownish cast. When they are squeezing the bag, some of the lac falls on the earth, in which case it takes on a button form, or drop, and hence is called button-lac. If these drops are large and spread out, they become plate-lac. Stick-lac is the resin still on twigs, but which have been broken for convenience in carrying. Under the lac trees are found quantities of lac that has been forced from the tree by winds or other means, and all this is carefully gathered up by the natives and sold as seed-lac. Briefly, shell-lac is superior because the best prepared.

Pure shell-lac is simply a combination of several peculiar resins, combined and mixed together as only the little lac insect can do it. This lac is important because of its adaptability for making varnish. Lac is easy of dissolution. In alcohol, also in a solution of borax, it gives a fine, hard varnish, capable of taking a depth and brilliancy of polish not attained by any other resin or

manufactured varnish. It is well known that the famous French polish is superior to any other form of varnish polish, being of simple composition, and it is readily rubbed to a high luster.

Adulteration of Shellac.— The best grade of orange shellac can be bought from any reputable dealer, but the white shellac is almost sure to be sophisticated. This because it is so easy to adulterate, it having to go through the bleaching process to make it white. Being more expensive to manufacture, a little adulteration helps lighten the cost. It is also likely to contain some water.

Where orange shellac is adulterated the precipitation and drying differ from the action of the pure gum. If rosin is present — a very usual adulterant — the alcohol will hold the rosin in solution and precipitate the shellac down, the shellac being the hardest to dissolve, there being very few substances that will dissolve it. Rosin causes shellac to dry soft. In the case of pure shellac the finisher may apply two coats in a day and rub down each and produce good work. But a coat of rosin-shellac will remain tacky for hours, so that one cannot rub more than the one coat a day. But note that not more than one coat a day of pure shellac is best for good work; see directions for finishing wood. It is true that shellac when pure may be applied as often as three coats a day, and be rubbed down, but it is not advised. An expert finisher says: "A pure shellac varnish should be fit to handle in six minutes after application, and be fit to sandpaper in thirty minutes, without gumming the sandpaper. The second coat should dry in seven minutes, it having been applied within thirty minutes after the first coat. In two hours apply the third coat, which should be hard to the touch in ten minutes. In one hour after applying the third coat it should be fit to rub down with oil and pumicestone." It must be repeated, that such quick work will not insure permanent finishing.

Bleached or White Shellac.— It may be made in different ways. One way is, to boil the orange shellac in a weak solution of carbonate of potash, and when dissolution is effected to collect the shellac, melt it under water, and while it is soft to pull it until it has a satiny appearance. Another way is to boil the shellac in a weak solution of potash, and while it is in a melted state pull and work it, until white enough. Then remelt it and pull again in clean warm water. All this reads like easy work, and it is, on a small scale, as for your own use, but on a commercial scale it is rather more difficult, requiring at least twelve operations, namely:

Crushing the raw shellac to a powder, so that it will be more readily soluble in the alkaline solution, separation of the coloring principle from the resin, preparation of the bleaching agent, or hypochlorite of potash or soda, treatment of the liquefied shellac by the bleaching agent, diluting the bleached shellac dilute alklaine solution in water, preparing the sulphuric acid for neutralizing the alkaline solution of shellac, neutralizing the shellac alkaline solution by the use of dilute sulphuric acid, which coincidently precipitates the bleached shellac, filtering the precipitate or pulp of the bleached shellac to develop whiteness and elasticity, hardening and whitening process of the sulphurous acid bath, which prevents to a very great extent the white shellac turning yellow when exposed to the light, drying the bleached shellac, and crushing the bleached shellac.

Here is another method, for shop use. Dissolve one pound of shellac in two pounds of strong alcohol, the absolute if that is possible, and leave it in a warm place for a few days. Then prepare a mixture of one pound of (20 per cent.) bleaching powder with three pounds of water, filter through a linen cloth, and wash the residue with one-half pound of water, the two waters being united and mixed with a 33 per cent. aqueous solu-

tion of potash until no further precipitate is formed, 4½ ounces of potash being generally sufficient per pound of bleach. The filtrate from this treatment is stirred into the warm solution of shellac, and at the end of a half-hour sufficient hydrochloric acid is added to produce a decided acid reaction, whereupon the shellac will be deposited as a perfectly white mass, which is removed from the liquid and washed with boiling water until the washings cease to run off milky. The shellac is then molded into strips, which are dried in the sun and open air. The acid liquor being neutralized with quicklime can be distilled to recover the alcohol.

Bleached shellac comes in granular form for easy "cutting" or dissolution with alcohol, it being more difficult to "cut" than the orange shellac. Some samples show more difficulty than others, all depending upon the care used in the bleaching, for if any lime is left, through scant washing, it will be harder for the alcohol to act on the shellac. It has been advised to put such shellac for a time in clear warm water, to draw out the lime, after which the shellac may be thoroughly dried. It is at least worth trying. When the gum is placed in alcohol for making the varnish the mass had better be placed on a hot water bath, which will facilitate the process, shaking it occasionally. Add two pounds of the gum to the gallon of alcohol, and strain carefully after the gum has dissolved; some of it may not dissolve, and it is this that must be strained out. Keep the shellac varnish in a glass or earthen vessel, tightly stoppered, never in metal. Contact with metal darkens bleached shellac, and this discoloration may be removed, it is said, by the addition of a very little oxalic acid, but whether the acid would do any harm when used in finishing is not known to me. It is also said that the addition of a little oxalic acid to the white varnish at the time it is being dissolved in alcohol will prevent dis-

coloration or darkening. White shellac is liable to deteriorate with age, a fact due to the improper preparation of same; in this condition it is stringy and does not dissolve readily in alcohol. If the white gum shellac you have has been on hand for a long time it would be better to discard it, unless in great quantity.

In the preparation of bleached shellac it is important that every last vestige of lime (chloride) be washed out, or that the acid be strong enough to neutralize the lime. The granulated form of white shellac is particularly liable to work badly, hence it is best to buy the shellac in hanks, keeping these under water, changing the water frequently, and skimming off the scum from time to time. Or the hanks may be kept in a crate or barrel, with water in the bottom, covered over with burlap or other suitable cloth. Of course, when wanted for use it must be thoroughly dried out, to remove every vestige of water.

Shellac is refined in the following manner: In a suitable boiler 1½ parts of soda are dissolved with 45 parts of water; to this are added in gradual portions as it dissolves 5 parts of gum shellac. This gives a violet-red color, with more or less traces of fatty substances. After complete solution the mixture is boiled for a few minutes, and the boiler is then covered down with a wooden top, which is cemented down. The contents of the boiler are cooled slowly, and the grease on the surface of the solution is skimmed off, the shellac is precipitated with sulphuric acid, drop by drop, and well washed with water until all acid reaction is removed. The shellac is then put into boiling water and softened, so that it may be worked into rods or plaits, and it is hardened by placing it in cold water containing some glycerine. The refined shellac should have a silvery to a yellowish-white surface, with a yellowish-white fracture. It should be perfectly dry and soluble in alcohol.

When overtreated with chloride of lime white shellac is partly insoluble in alcohol, as has previously been pointed out. Formerly no treatment for its restoration was known but it has been discovered that if such shellac is first moistened with one-twentieth of its weight of ether and allowed to swell in a close vessel its solubility in alcohol will be restored.

The stronger the alcohol the better its cutting power, but sometimes it answers to pour off the first alcohol, after it has been on the gum for a while, and replace it with fresh alcohol.

Sometimes white shellac will show a decided acid reaction, due to insufficient washing of the bulk shellac after its precipitation by sulphuric acid. Such a shellac is always difficult to dissolve. To neutralize the acidity add two ounces of caustic soda to one pint of boiling water, adding this to ten gallons of the shellac varnish. This will correct the acidity and make the shellac very soluble in alcohol.

The affinity of alcohol for water is so great that if only a very little water is added to a solution of alcohol shellac the water will combine with the alcohol, while part of the shellac will precipitate or separate from the solution. It is for this reason that the nearer "absolute" the alcohol is the better will it dissolve any shellac gum, white or orange. At least ninety-five per cent. should be required of the alcohol. The least particle of water in it will result in the precipitating of more or less of the gum.

Orange Shellac.— Like the white variety, orange shellac should dissolve in alcohol without residue. This whether wood, grain or denatured alcohol is used. A great deal depends on the method employed in making the shellac, on the presence or absence of rosin, of which more further on. As to orange shellac, given the same degree of strength of the solvent, there will always be

a uniform result in the varnish making. Experiments have shown that with the best grade of alcohol there is no difference in the dissolving power of wood and grain alcohol and denatured alcohol. There is a difference in behavior of grain and wood alcohol on crude lac, as Singh has shown. Whereas, grain alcohol dissolves both the lac and the coloring matter associated with it, the wood alcohol dissolves only the lac. By treating 100 lbs. of crude lac with methyl (wood) alcohol in an extraction apparatus similar to that of Soxhlett he was able in the course of two or three hours to extract a product which is stated to be equal to the best shellac on the market. He suggested that the lac be placed on the market in the form of a coarse powder, instead of the shell form, and thus do away with the necessity of stretching the lac while in the plastic state, with the object of eliminating the rosin which is added at this stage to facilitate the manipulation. The addition of rosin to shellac is carried on so systematically, and the different brands are so well known, that a change is scarcely likely.

Concerning the use of wood and grain alcohol for dissolving shellac, while both have the same power, as stated, yet there is a difference in the behavior of the two when being used, and after application. For instance, grain alcohol has a pleasant, sweetish smell, and it does not affect the eyes; it works freely, sets reasonably slow, and dries hard. Wood alcohol sets so quickly that it is difficult to spread it well and it cannot be used at all for french-polishing, as it "drags" so badly. And although it sets quicker, it hardens slower than grain alcohol shellac. Denatured alcohol contains ten per cent. of wood alcohol, hence is to that extent inferior to the pure grain article. Yet it does very well, though it must be remembered that some denatured alcohol contains coal oil or benzine, and this is not fit for the dis-

solution of shellac. Some contains turpentine, but in any case the denatured alcohol containing any of these liquids will, when mixed with an equal amount of water, give a milk-white liquid. But when alcohol has been denatured with wood alcohol alone no such effect is produced. An easy test.

Preparing Shellac Varnish.— An authority states that about four-fifths of the shellac made in this country is made by dissolving five pounds of either white or brown shellac in a barrel, suspended on a center, and revolved at a speed of about 50 revolutions a minute. The resultant varnish is rather thin, having a tendency to settle. A good bodied shellac may be made by adding twenty-four ounces of best brown shellac, say D.C., or V.S.O., to the gallon of ninety-five per cent. alcohol. With brown button-lac, which is heavier and contains impurities, it will take two pounds to make a varnish equal in body to the former. To make a white shellac varnish add two pounds of white shellac to three quarts of ninety-five per cent. alcohol; this gives a good bodied varnish, using grain shellac. These varnishes may of course be reduced for use if desired.

For shop use you may add as much as four pounds of shellac to the gallon of alcohol, or as much as the alcohol will cut, and then it can be thinned as used. It should be kept in a warm place in cold weather.

If it becomes too thick by evaporation, or has deteriorated by leaving the stopper off, in which case moisture from the air will have been taken in by the alcohol, try adding a little turpentine to the mass, shaking it well.

On the commercial scale shellac is usually cut in the proportion of 3, 4, and 5 pounds of lac to the gallon of alcohol, while an extra heavy shellac varnish is made by using 6¾ pounds of lac to the gallon. Use 95 per cent. alcohol. As one gallon of 95 per cent. alcohol

weighs 7.75 to 7.80 pounds per gallon, the solution will contain about 50 per cent. of shellac by weight.

Artificial Shellac.— Many furniture makers use shellac over paste filling, thus saving a coat of varnish, and the shellac also stops suction left where the filler failed to perfectly satisfy the wood. At much less cost a substitute shellac may be used, one having good surfacing qualities and one that may be thinned with benzine or turpentine. There is on the market what in the trade is known as French kauri gum, a substitute for the true and costly kauri. Here is a factory formula for making a substitute containing the French kauri. Shellac, 100 lbs., French artificial kauri, 50 lbs., common rosin, 50 lbs., gum camphor, 1 oz., acetone, 5 gals., and wood alcohol, 30 gals.

The true color of orange shellac is hard to get in imitation brown or orange shellac, but one ounce of tincture of aurine, which is of mineral origin, will color a gallon of shellac substitute to the required true orange shellac color. Aurine will dissolve in either wood or grain alcohol. The process is a factory one, and not for the shop or small user. It may be bought ready made.

Considerable imitation shellac is used for dipping articles in, in factories, or half and half of rosin and brown shellac, 2½ lbs. of each to the gallon of denatured or wood alcohol. The rosin is pulverized. This gives a very dark shellac, and a lighter one may be made with white shellac and a light rosin, what is called water-white rosin being best for a very light liquid. Add more alcohol if desired thinner. Color also may be, and usually is, added to this dipping shellac.

An excellent imitation of orange shellac may be made by a combination of Manila gum, prepared rosin, and an alcohol substitute. This latter is made from a mixture of liquid ingredients, and the resultant product presents

the aspects of a variety of lacquer, while disclosing some of the peculiar features of genuine orange shellac with regard to drying and rubbing properties. Alcohol forms a part of the liquid solvent. Manila dust, with or without rosin, is used in place of the real shellac. Manila dust dissolves quickly at an ordinary temperature in alcohol, producing a quick-drying varnish, but while quite transparent, it does not flow well, a characteristic of all spirit varnishes, however.

Mention has already been made of the substance aurine, for coloring imitation shellac, which see, for the formula of the imitation explained here uses that coloring.

The liquid solvent mentioned is composed of four parts wood alcohol, two parts fusel oil, and one part of benzole, the liquids being thoroughly mixed. In the mixture is placed a fractional quantity of aurine, which is dissolved under constant agitation, or stirring. When the solution is complete it is allowed to settle and clarify before using. An ounce of this aurine tincture suffices for a gallon of imitation shellac.

An English factory employs the following formula for making an imitation shellac varnish. The process calls for a revolving petroleum barrel, in which are placed the solids: Manila dust 100 lbs., prepared rosin 50 lbs., common rosin 50 lbs., wood alcohol 25 galls., alcoholized naphtha 5 galls., acetone 3 galls. Then the liquids are placed in the barrel, which is then set to revolving for about four hours without cessation. By that time the solids will have dissolved, when the aurine tincture may be admitted, using one quart of it. The varnish is then ready for use, but if allowed to stand for a period of time it will clarify some.

The foregoing descriptions of methods for making artificial shellacs or substitutes are not intended for the practical use of finishers, who could hardly be expected

to manufacture the substance on any such scale, even if willing, especially when such varnishes may be bought ready made at a reasonable price. The idea in presenting such processes is to show the workman how such things are produced; the descriptions are intended to be purely educational.

Here is a shellac substitute, however, that any workman may easily prepare in the shop. Take four pounds of China clay or finely pulverized silica and stir into it a quart of good japan liquid driers, beating the mass to a smooth paste. While stirring briskly add 1½ gallons of the best hard oil finish or similar varnish, and then let the mass stand an hour or so; finally strain through a fine sieve; thin up with turpentine or benzine for use, very thin for soft wood, and heavier for hard wood.

Water Shellac.— Shellac dissolved with water and an alkali dries much slower than alcohol shellac, but when dry it sandpapers and rubs just as well as the other, nor will it raise the grain of the wood as badly as alcohol shellac does. It sandpapers even easier than the other shellac does. For cheap work it makes a very satisfactory undercoating for varnish. As it does not set quick it may be brushed out better or smoother than alcohol shellac, hence requires less rubbing.

Mixed with a strong solution of brown or white glue, according to character of work to be done, equal parts of glue and shellac, a good filler may be made for cheap work, that will bear out the varnish very nicely, and give a clean job with one coat of filler and one coat of cheap varnish. Two coats of better varnish will of course give a better finish, but costs more.

To make water shellac, take one pound of pulverized shellac and one-half pound of powdered borax, and in a porcelain vessel containing a gallon of rain or soft water place these ingredients, place on stove and boil until dissolved; a water bath is better. There will be some resi-

due from the shellac, likely, so that the liquid must be strained through cheesecloth; boil down to proper consistency. While some believe the addition of a little alcohol improves the shellac, yet this is not certain, but the addition of about 8 ounces to the gallon may be used for the purpose of making it have the odor of alcohol shellac. Some indeed mix together equal parts of alcohol and water shellac, but this increases the cost of the article to that extent. Possibly the addition of more or less alcohol to water shellac may improve its quality.

A Clear Alcoholic Solution of Shellac.— To make this form of shellac pour six parts of strong grain alcohol over one part of bleached gum shellac, and shake occasionally until the lac is dissolved, which will require about ten to twelve hours. Then add one part of powdered chalk, and heat the mass over a water bath; let it then stand until it becomes clear, then pour off the clear portion and strain the sediment through filter paper, assisting the operation with a little alcohol.

SOME NOTES ON SHELLAC.

A little gum camphor added to shellac (or to copal varnish) will make it more pliable, or easier to spread.

Any excess of moisture in shellac varnish may be removed by placing strips of gelatin in it; gelatin absorbs moisture readily. The strips can be removed after a short time. Old shellac is apt to become dull and spongy, by the evaporation of the spirit, which has previously absorbed some water, which is left behind. Some prefer adding a little turpentine to it.

Shellac is easily dissolved by an alkali, hence when it is desired to clean the shellac brush, soap and water will do it, first working it out in alcohol, to remove excess of shellac. In this way the brush may be kept clean and ready for use at any time. Any object coated with shel-

lac may in the same manner be cleared of the varnish by means of an alkali.

In making up shellac varnish, remember that it takes less white shellac to the gallon of alcohol than brown shellac; where 3½ lbs. of orange shellac is used for a gallon of alcohol you would use but 3¼ lbs. of white.

To color shellac varnish black, use lampblack; for red use Chinese vermillion; for blue use Prussian blue. A very good quality of blue cannot be obtained. The colors should be dry and ground to a very fine powder. To mix, add the color to a little of the varnish, and work it to a smooth paste; then add varnish, and also alcohol if necessary, in proper quantity to make the mixture spread well.

To pulverize brown shellac, place it in a strong bag, and beat with a mallet. Now and then sift out the finer parts and resume the hammering until all is pulverized.

By adding about one-half ounce of oxalic acid to the quart of orange shellac varnish its color is brightened and the most of the impurities are removed. After adding the acid stir it, let it settle over night, then pour off the clear solution, throwing away the dregs.

Shellac varnish that shows a tendency to work "short" and show frills on the work, may be improved by the addition of a few drops of lavender or almond oil.

A French cabinet maker gives this as a good formula for shellac varnish intended for floor or furniture: Five pounds of pale orange shellac, one ounce of gum mastic, and five or six pints of alcohol; dissolve cold in order to prevent evaporation, stirring constantly.

If we mix rosin with pure orange shellac in the proportion of one-fourth of the latter to three-fourths of the former we get a varnish that will dry in the same time as pure orange shellac, while its adhesive power will be equal if not indeed superior to the pure alcohol-

shellac varnish. But the pure shellac will give a harder coating than the one containing the rosin.

By mixing two-thirds shellac with one-third rosin we get a slower drying varnish, and one with a softer coating. Still, such a mixture will give very fair results, as it may be rubbed after about four or five hours, the second coating giving a high-gloss finish.

When the shellac works tough under the brush try adding to it a little Venice turpentine. Gum camphor, as advised in the beginning of these notes, is also useful.

Thin shellac varnish will cover about 400 square feet of white pine to the gallon, first coat. And 500 square feet to the gallon for the next coat.

Gum camphor has the peculiar quality of making other gums flexible, and it may be added to any spirit varnish, though never in any large quantity, one ounce to the gallon of shellac or sandarach varnish being enough. To celluloid varnish it may be added to the extent of 25 per cent. of the guncotton.

Use a glue-set brush for applying shellac or any spirit varnish, as the alcohol will not affect the glue.

Two coats of shellac, applied thin, are better than one heavy coat. Steel wool is better than sandpaper for smoothing between coats. Make no misses when shellacing, and never touch-up any missed part. Keep surface smooth.

Thin up your shellac with pure alcohol, preferably grain, the denatured article answering when it does not contain any petroleum product. Some add a little turpentine.

If brown shellac varnish, after application, turns white it is sure that it contained some water. As water mixes readily with alcohol some may have been added by the seller.

Filter white shellac through several folds of cheesecloth. Keep in a well stoppered bottle or jar.

Adding a pound of Venice turpentine to the gallon of shellac that has been cut with wood alcohol will make it work easier under the brush. The proportion is, ten per cent. of the Venice turpentine to the shellac, by weight.

Shellac varnish containing rosin is better used soon after making, or within reasonable time, as the lac will precipitate to the bottom in time, like a mass of rubber, and this mass never can be dissolved again.

Grain alcohol denatured with wood alcohol alone can be used by varnish makers only, and is not sold to the general public. Ordinary denatured alcohol contains one per cent. of benzine, enough to injure the drying of the shellac, but not seriously. Shellac varnish manufacturers obtain the "special denatured" alcohol without benzine by filing a bond with the Government that they will not sell any shellac varnish containing less than two pounds of lac to the gallon. The best shellac varnish can not be made with benzine-denatured alcohol.

Considerable shellac is mixed with Manila gum, by which adulteration it lacks in hardness and elasticity; such should have a little Venice turpentine added to it.

Nearly every user of shellac uses more or less T. N. shellac, and yet he may not know it, simply because he never meets with the lac under that name. Yet it comprises sixty per cent. of all the shellac made in the course of the year. These initials stand for TRULY NATIVE, and it represents a very dark lac, selling at a low price. For any shellac purpose where color does not count it is as good as any at any price.

Medium grades of orange, in which the dark lac is made paler by the use of arsenic, commonly known as orpiment.

High grades of fine orange shellac, made from the highest grade of stick lac, which is known as "Koosmie," and is gathered late in the fall from the *Palas* tree. A very clean grade of lac, with little or no orpi-

ment, and used mostly by makers of high-grade furniture, for backs of mirrors, pattern work, and for plastic or composition materials.

Garnet lac, the lac with the dye left in it, and used mostly by hat makers and makers of shoe blacking; it is made either pure or with ten per cent. added rosin. Years ago lac was used for its dye, the lac being discarded.

Button lac is the same as orange shellac, only it contains more natural wax. It gets its name from its form.

Tongue lac is exactly the same as button lac, differing in form only.

Stick lac is the crude lac as it comes from the trees.

Seed lac is the same as stick lac except that it is ground and washed, the lac dye being either partly or entirely removed. Used mainly by lacquer manufacturers.

Kal is an inferior garnet or button lac, and is made from the refuse from the other lacs. It contains also a large percentage of added rosin.

On a hot, humid day shellac may become like sour cream in appearance, due to the absorption of water. In the best furniture finishing rooms shellaced articles are placed in a hot drying room as soon as they are done, this even in hot weather.

To test shellac for purity, mix with ether; as shellac is insoluble in ether the presence of rosin is shown by partial solution.

Shellac is the hardest known gum. Were it possible to dissolve it in turpentine or linseed oil, the same as with varnish gum, it would make the most durable of all varnishes for exterior work, in contact with atmospheric conditions. As it can be dissolved only in grain or wood alcohol it is useful only for interior work.

CHAPTER XX

A GLOSSARY

ACID.— *Acetic.*— A colorless, pungent liquid, usually obtained by the destructive distillation of wood, or by the oxidation of alcohol with ferments. The acetic acid of commerce is an aqueous solution containing 33-36 per cent. of glacial (pure) acetic acid. Vinegar contains 4 5-12 per cent. *Boracic.*— A colorless crystalline compound, obtained largely in volcanic lagoons of Tuscany, Italy, and found in chemical combinations, as borax. *Carbolic.*— A white crystalline deliquescent compound with a burning taste, and an odor resembling that of creosote, contained in the heavy oil of tar, from which it is distilled. It is a caustic poison. Known also as phenol. *Hydrochloric.*— Known in commerce as muriatic acid. The only known compound of chlorine and hydrogen. Obtained when equal quantities of chlorine and hydrogen are mixed and exposed to the diffused light of day, the gases then combine, and form an unaltered volume of hydrochloric acid gas. The acid may, however, be more easily prepared by heating sodium chloride (common table salt) and sulphuric acid in a flask. This acid is a colorless gas, 1.269 times heavier than air, it fumes strongly in damp air, combining with the moisture, and has a strong acid reaction. It is very soluble in water, one volume of the acid at 15 deg. dissolving 454 volumes of the gas. This solution is the ordinary hydrochloric or muriatic acid of commerce. *Muriatic.*— So called because it was formerly thought to be an oxide of an unknown element,

Murium. Also called hydrochloric acid, which see. *Nitric.*— Formed by the action of sulphuric acid on nitrates and by other means. The pure acid is a colorless, fuming, corrosive liquid. Ordinary commercial nitric acid is yellowish in color. This acid is very active, dissociating very readily in water, and having also strong oxidizing qualities. It attacks most metals and certain other elements. It yellows and corrodes various organic compounds. Known also as *Aqua Fortis,* or strong water. *Oxalic.*— A white crystalline poisonous compound found extensively in the vegetable kingdom, also made by the decomposition of sugar, etc., with nitric acid. Also called salts of lemon. *Picric.*— A yellow crystalline compound obtained by the action of nitric acid on phenol, and by other means. *Pyrogallic.*— Obtained from gallic acid by heat. Gallic acid is found in sumac, gallnuts, tea, etc. Made usually by decomposition of gallnuts by fermentation. *Salicylic.*— A white crystalline compound contained in many plants, and also made from phenol. *Sulphuric.*— A colorless, very corrosive, oily liquid compound. Originally made by distilling iron sulphate (green vitriol), hence its name, oil of vitriol. It is the most important acid used in the arts. Do not confound it with *sulphurous acid* (sulphur dioxide), which is simply the fumes of burning sulphur combined with the oxygen of the air; the burning brimstone match gives forth sulphurous acid. There are various methods for making sulphurous acid, which need not be given here. *Tartaric.*— A colorless crystalline compound occurring largely in the vegetable kingdom, either as a potassium or calcium salt. Usually prepared commercially from *argol,* which is the crude tartar found at the bottom of wine casks.

Acetone.— An inflammable liquid with a biting taste, obtained by the destructive distillation of certain acetates, citric acid, starch, sugar, or gum. Used in making

chloroform, and as a solvent for fats, camphor and resins.

Alcohol.— *Ethyl.*— Grain alcohol. Obtained by fermentation and distillation of rye, wheat, etc. *Methyl.*— Wood alcohol, wood spirits, carbinol; distilled from wood. *Denatured.*— The addition of ten per cent. of wood alcohol " denatures " it, according to law. For general commercial use benzine is added, the first mentioned article being allowed to manufacturers of varnish, etc., only, under special permit. Hence, denatured commercial alcohol is not so desirable for many uses that a painter and wood finisher finds for alcohol, owing to the presence of the benzine. In Great Britain denatured alcohol is known as methylated spirits. *Absolute.*— Absolute alcohol is that which is entirely free of water, a condition not obtainable by ordinary distillation, and effected only by the use of some dehydrating substance, as quicklime. Commercial absolute alcohol contains about one per cent. of water, and is used only for special purposes. As used in the U. S. Pharmacopœia *alcohol* means a solution of ninety-one per cent. by weight of ethyl alcohol and 9 per cent. of water. *Proof spirit,* or dilute alcohol, 45.5 per cent. by weight of alcohol, 54.5 per cent. of water. *Amyl.*— Amyl alcohol is the principal constituent of fusel oil, etc.

Alkali.— Anything that will neutralize an acid, as lime, magnesia, ammonia, soda, potash, etc.

Alkanet.— A red color extracted from the roots of a plant, the *Alkanna tinctoria,* found growing in Europe and America.

Alizarine.— An orange-red crystalline compound formerly obtained from the madder plant, but now made from the coal tar product, *Anthracene.*

Aloes.— An intensely bitter resinous substance consisting of the inspissated juices of the leaves of several species of the aloes.

Alum.— Sulphate of potash and aluminum. Potash alum.

Ammonia.— A colorless gaseous compound of hydrogen and nitrogen. Aqua ammonia or ammonia water is a solution of gaseous anhydrous ammonia in water. It should contain ten per cent. of the gas by weight, and the "stronger ammonia" twenty-eight per cent. Ammonia is very soluble in water, liquefiable and solidifiable by cold and pressure; it is strongly alkaline and combines readily with acids to form ammonia salts.

Ammonium.— *Phosphate.*— A combination of ammonia and phosphoric acid. *Sulphate.*— A salt formed by the union of ammonia and sulphuric acid. *Chloride.* — Sal ammoniac, which see. *Carbonate.*— A variable mixture of ammonium bicarbonate and ammonium carbonate.

Aqua Regia.— Meaning "Royal water." Certain metals, such as gold and platinum, and many metallic compounds, such as certain sulphides, which do not dissolve in either nitric or hydrochloric acid separately, are readily soluble in a mixture of these two acids, especially upon warming.

Aniline.— An oily poisonous basic liquid, colorless when pure, now chiefly made by the reduction of nitrobenzene. It may be regarded as ammonia in which one hydrogen atom has been replaced by the radical *phenyl.* In commercial language aniline, or aniline oil, for blue, signifies pure aniline; aniline for red, a mixture of aniline and o-and-p-toluidine; and aniline for safranine, aniline containing o-toluidine.

Annotta.— Annatta, arnotta, etc. A red or yellowish-red dye prepared from the pulp surrounding the seeds of a tropical American tree.

Antimony Trichloride.— Butter of antimony. A compound obtained as a soft, white, fuming crystalline mass by dissolving antimony trisulphide in hydrochloric

acid and distilling. Butter of antimony enters into most formulas for furniture polish, because it is a good cleanser, without affecting the luster.

Barium Chloride.— A salt obtained by fusing barite, a native sulphate of barium, with calcium chloride.

Barytes.— Sulphate of baryta. Most important of the salts of barium. Barytes is commonly known as heavy spar.

Benzene.— Obtained by distilling benzoic acid with lime, and by the action of heat on various organic substances. Obtained commercially by the destructive distillation of coal.

Benzine.— Obtained by distillation from petroleum.

Benzol.— Also benzole. In Germany, and to some extent in Great Britain, the term *benzole* is used for what we call *benzene*. Benzol is a mixture of the benzine series, obtained in the refinement of coal tar. The two principal varieties are known as 90 per cent. benzol, and which actually contains about 70 per cent. benzene, 24 per cent. toluene, and 6 per cent. xylene, carbon disulphide, and other substances, and 50 per cent. benzol, containing relatively more toluene and xylene, and almost no carbon disulphide.

Brazilwood.— A number of tropical American trees yield dyes, as the sapanwood, peachwood, limawood, camwood, barwood, brazilwood, and red sanders or sandalwood. These give red or purple dyes.

Brunoleine.— A preparation used to give the appearance of age to oak, or to make imitation old oak. To make it, boil 7 parts of linseed oil with 2 parts of litharge and 2 parts of red lead in a large kettle until the pale red liquid is converted into a thick brown mass which becomes solid when cold. Reduce this solid body into pieces, pour 16 parts of turpentine over it and dissolve by stirring or by the use of heat. This is filtered through linen, and the clear liquid obtained is mixed with 3 parts

of wax-turpentine solution. If necessary, color with a solution of asphaltum in turpentine for a lively brown tone.

Campeachy Extract.— Logwood extract.

Carbonate.— *Magnesia.*— The white magnesia is a varying mixture of carbonate and hydrate, made by precipitating a hot solution of magnesium sulphate with sodium carbonate. *Potash.*— Commercially known as pearlash and potash. *Soda.*— Known in commerce as soda ash. Made on a large scale from sea salt.

Caustic Soda.— Sodium hydroxide. Made by boiling lime and carbonate of soda together with water, and evaporating down the clear solution.

Carbon Disulphide.— A clear liquid which, when not perfectly pure, has a very offensive odor. Dissolves rubber, etc.

Carmine.—There are several carmines. Made from the cochineal insect. Carmine lake is made from carmine and alum. Indigo carmine is of the same class.

China Clay.— Kaolin. A very pure white clay, obtained from the decomposition of aluminous minerals, especially feldspar. Known also as porcelain clay, because used in making fine porcelain ware.

China Wood Oil.— Tung oil. Described at some length in another part of this book.

Catechu.— That mostly used is called Bengal catechu, and is an extract of the wood of either of two East Indies acacias. Gambier catechu is from an East Indies shrub. Cutch is from several tropical Asiatic plants. The wood, leaves, or fruits are used in obtaining the coloring matter, by decoction and evaporation.

Chloride of Lime.— Calcium chloride. A mixture of calcium and calcium hypochlorite; bleaching powder.

Chloride of Sulphur.— Sulphuryl chloride. A colorless, slightly fuming liquid, obtained by direct union of

sulphur dioxide and chlorine by sunlight and otherwise. Treated with water it decomposes, forming sulphuric and hydrochloric acids — hence also called sulphuric chloranhydride.

Collodium.— Collodion. A viscous liquid consisting of a mixture of alcohol and ether in which soluble gun-cotton or pyroxyllin is dissolved. On evaporation of the solvents the pyroxyllin remains in a tough adhesive form, in which condition it is used for photo-films, etc.

Copperas.—Ferrous sulphate. Sulphate of iron. Green vitriol. A green crystalline substance.

Creosote.— An oily liquid, colorless when pure, but usually colored yellow or brown by impurities or exposure. It is obtained by the distillation of wood tar, especially that of beechwood. A similar substance is obtained from coal tar. Creosote is obtained from creosote oil by purification.

Cupric Chloride.— Chloride of copper. Formed when copper is brought into chlorine gas, or when copper oxide is dissolved in hydrochloric acid; it forms green needle-shaped crystals, soluble in water and alcohol.

Cupric Sulphate.— Sulphate of copper, blue vitriol, bluestone. Largely made by dissolving copper oxide in sulphuric acid. It crystallizes in large blue crystals.

Dammar.— A resin obtained from various pinaceous trees of the genus *Dammara,* in Australia, New Zealand, and the East Indies. D. Alba is from the Amboyna pine; D. Australis is from the Kauri pine. Batavia dammar simply means that it came from the principal shipping point, of that name. The so-called Batavia dammar is considered to represent the best.

Decoction.— Applied to the extract of a substance secured by boiling in water.

Dextrine.— A soluble gummy substance obtained by the action of heat, acids, or ferments on starch. When

pure it is a white amorphous solid, tasteless and odorless. There are several varieties, and it is used as a substitute for other and costlier gums.

Digest.— To extract soluble substance as from bark, etc., in alcohol; to soften by heat or moisture.

Dragon's Blood.— The true dragon's blood of commerce is obtained from the Malayan rattan palm, from whose fruit the resin exudes. Socotrine dragon's blood, from the island of Socotra, is probably the "cinnabar" of the ancients.

Epsom Salts.— Magnesium sulphate. Obtained mainly from the mineral *kieserite*. Formerly obtained by boiling down the mineral waters of Epsom, England.

Ether.— Obtained by the distillation of alcohol with suphuric acid, hence also known as sulphurous ether. A powerful solvent of fats, oils, resins, etc. Anæsthetic.

French Berries.— The fruit of several European species of *Rhamnus*. Produces a yellow dye.

Fusel Oil.— An acrid, oily liquid of vile odor, accompanying the making of potato spirits, corn spirits, etc. It consists chiefly of amyl alcohol, hence is known also as amyl alcohol.

Fustic.— A light yellow dye obtained from the wood of a tree growing in Mexico and West Indies.

Gamboge.— An orange-red resin, which becomes bright yellow when powdered. The best comes from Cambodia, Siam.

Gelatin.— Animal jelly or glue. Isinglass.

Glycerine.— A sweet syrupy liquid, colorless, odorless, and obtained by the saponification of the neutral fats and oils, which are composed of glycerin with various acids. It is a by-product of soap and candle factories.

Glauber Salts.— See Sulphate of Soda.

Gum.— Any of a number of amorphous, tasteless substances, exuded in most cases by plants, and hardening

on exposure to the air. Their chief constituents are certain carbohydrates, as arabic acid, bassorin, etc. Some (true gums) form clear solutions with water, while others (vegetable mucilages) swell up in water into a glutinous mass. All are insoluble in alcohol. They may be true secretions, or transformation products of cellulose, as in cherry gum, etc.

Loosely, any of various plant exudations, including the gums proper, resins, gum resins, etc.

Gum resins are essentially a mixture of gum and resin, usually obtained by making an incision in a plant and allowing the juice which exudes to solidify by evaporation. Gum resins are, in accordance with their composition, partially soluble in alcohol. Some substances commonly called gums are gum resins; they usually originate as excretion products in special canals or glands. See also Resin.

Henna, Tincture of.— From the leaves of a thorny tree or shrub of Asia there is obtained a reddish-orange dye, called henna, or alhenna.

Indigo.— Made artificially from naphthaline. Formerly made entirely from the indigo plant, or from several indeed, but the indigo coloring did not exist in the plant as such, but was obtained by decomposition of *indican,* and which contains besides indigo blue various other substances, unless specially purified.

Indigo Carmine.— The sodium or potassium salt of indigotin disulphuric acid (indigo extract). Sold usually in the form of a paste.

Iron Acetone.— A liquid formed by the action of acetic acid on iron filings.

Japan.— Derives name from a varnish used in Japan and obtained by tapping a tree called the varnish tree. In the painting trade japan means a drying agent. There are various kinds, namely: Brown, which is the kind generally used by house painters for adding to paint

to assist its drying; of course there are several qualities or grades of brown japan. Black japan is really a black varnish, used by coach painters. Coach japan is a good quality drier used by coach painters. The color of a drying japan depends upon the siccative agent used, and the amount of boiling the liquid receives. The dark japan is a quicker drier than the light or so-called white japan. The latter is a very slow drier, but is useful in white paint or light tints. Japan gold size is light in color, but a strong drier. It all depends upon method of manufacture. For the wood finisher the dark japans are usually the most useful.

Kilo.— A prefix meaning *thousand,* used in forming names of units of measurement, as in kilogram, kilometer, kilowatt. A kilo is 2.2 pounds.

Keystone Filler.— A mineral found at Muncy, Penna., and much used by coach painters for mixing filler or roughstuff. It is a kind of umber.

Kaolin.— See China Clay.

Lacquer.— From lac, shellac, or shellac varnish.

Lead Acetate.— Sugar of lead. A drying agent, used in making "patent drier," and useful in white paint. A colorless or white crystal salt with a sweet, astringent and metallic taste, made by dissolving lead in vinegar, and in other ways. It is an irritant poison, producing burning pains, vomiting, etc.

Lime.— A caustic, highly infusible substance, white when pure, obtained by burning limestone, oyster shells, etc. Known also as quicklime. Calcium oxide. Lime slaked with water is calcium hydroxide. Lime slaked in the air is carbonate of lime.

Litharge.— A yellowish-red substance obtained by heating lead moderately in presence of air, or by calcining lead nitrate or lead carbonate. Practically the same as red lead.

Logwood.— The heartwood of a Central American

tree. It is very hard, and of a brown or brownish-red color. Imported in logs, hence its name. Logwood chips and extract are used in dyeing.

Malaxing.— To soften by kneading, rubbing, mixing, or by stirring some thinner substance.

Manganate of Soda.— A salt of manganic acid. Various manganates are formed as green masses by fusion of manganese dioxide with alkalies, oxides, or carbonates. Those of sodium (manganate of soda), potassium (manganate of potash), and barium are perhaps the best known.

Magnesium Chloride.— A fusible salt obtained by evaporating magnesia dissolved in hydrochloric acid with an equal quantity of sal ammoniac; on fusion, the latter salt volatilizes, and the magnesium chloride remains behind.

Marble Dust.— Simply crushed and pulverized limestone. Large quantities are used in making what is called "putty."

Neat's-foot Oil.— A pale yellowish fixed oil made by boiling the feet and shins of neat cattle. It consists almost wholly of olein and is used as a fine lubricant and leather dressing.

Nitrate of Silver.— A salt obtained in the form of colorless crystals by dissolving silver in nitric acid and evaporating it. In contact with organic matter it turns black.

Nickel Chloride.— See Chloride of Lime, concerning *Chloride.*

Oil of Amber.— Amber varnish.

Oxalate of Tin.— An oxalate is an ester or salt of oxalic acid.

Ozokerite.— Mineral wax. A waxy, translucent substance or natural paraffin, occurring usually in coal measures, sometimes in large quantities. See Paraffin.

Paraffin.— A wax produced in distilling wood, lignite,

coal, etc., and occurring in the earth as Ozokerite, either as a solid deposit, or as a constituent of petroleum. Pure paraffin is white or colorless and odorless and without taste. Chemically it is perfectly inert.

Parquetry.— A species of joinery consisting of an inlay of geometrical or other patterns, usually of various colors. Used especially for floors.

Petroleum Ether.— A term sometimes used to designate 62 deg. benzine.

Persian Berries.— The dried berries of various European and Asiatic species of *Rhamnus,* producing with tin salts a yellow lake.

Prussiate of Potash.— There are the red and yellow prussiates, the latter being non-poisonous.

Potash.— Caustic potash. Potassium hydroxide. Prepared by boiling 1 part of carbonate of potash with 12 parts of water, and adding slaked lime prepared from 2-3 part of quicklime. In this reaction calcium carbonate (chalk) is formed, which falls to the bottom as a heavy powder, caustic potash remaining in solution. The clear liquid, which should not effervesce on addition of an acid, is evaporated in a silver basin to dryness, fused by exposure to a stronger heat and cast into sticks in a metallic mold. This prepared caustic potash is a white substance, soluble in half its weight of water, and is highly corrosive to the skin.

Phenol.— A colorless or pinkish crystalline substance produced by the destructive distillation of wood, coal, etc., and from the heavy oil from coal tar. Its odor resembles that of creosote. Generally called *Carbolic Acid,* which see.

Plaster of Paris.— So called because originally brought from a suburb of Paris. Made from gypsum. When gypsum is moderately heated it loses its water, and becomes plaster of Paris. This, when moistened

takes up two atoms of water again and sets to a solid mass.

Pumice.— Pumicestone. A highly vesicular volcanic glass or froth, the color of which is white, gray, yellowish, or brownish, but rarely red. The imported is best for rubbing with, being free from grit, from which the American article is not sufficiently free.

Quercitron Bark.— The bark of a large timber oak of the Eastern United States, whose foliage resembles that of the red oak; its inner bark is yellow.

Resin.— Any of various solid or semi-solid organic substances, chiefly of vegetable origin, yellowish to brown (usually) transparent or translucent, and soluble in ether, alcohol, etc., but not in water. Resins soften and melt on heating and burn with a smoky flame. Chemically they differ widely, but all are rich in carbon and hydrogen and contain also some oxygen. Many are oxidation products of the terpenes and are produced as exudates from plants either alone or as mixtures with essential oils (oleoresins), with gums (gum resins), etc., being chiefly excretion products. Some are obtained from alcoholic extracts by addition of water, and some are made artificially, as by the action of caustic potash on aldehyde. The chief constituents of the natural resins are certain esters and acids and resenes. Among the resins of commerce are: Amber, copal, dammar, guaiacum, lac, mastic, rosin, and sandarach.

Rosin.— The residue from the turpentine still. Known also as North Carolina copal. Its better name perhaps is colophony.

Rose Pink.— Whiting dyed with a decoction of brazilwood and alum.

Rose Madder.—An alumina lake of madder or alizarine; of a pale rose color.

Rose Lake.— Same as Madder Lake.

Rottenstone.— A friable siliceous stone, the residue of a siliceous limestone whose calcareous matter has been removed by the solvent action of water. Also called Tripoli powder.

Sal Ammoniac.— Ammonia and its compounds are now obtained mainly from the ammonia liquors of gas-works. Adding hydrochloric acid to the liquid and evaporating the solution produces the sal ammoniac of commerce. Quicklime and sal ammoniac give chloride of lime.

Salt.— Table salt. *Sal culinarius.* Chloride of soda. It is from this salt that almost all the other sodium compounds are prepared.

Sal Soda.— Washing soda. Soda carbonate. Soda crystals. Carbonate of soda, which see.

Saturated Solution.— When water has taken up all of a solid that it can hold in suspension, as of salt for instance, it is said to be a saturated solution.

Savogran.— A commercial cleanser containing certain alkaline substances.

Soda Ash.— Same as carbonate of soda.

Sulphate of Soda.— Glauber's salts is the commercial term.

Spirits of Wine.— See Alcohol.

Stannous Chloride.— Obtained by dissolving tin in hydrochloric acid; it separates out in needle-shaped crystals, when the solution is concentrated. In commerce known as tin salts. Used in dyeing and as a mordant.

Sweet Oil.— Oil from the olive.

Sulphate of Hydrogen.— Hydrogen sulphate, known in commerce as brown oil of vitriol. A thick oily liquid, combining with water with great force, and used in the laboratory as a drying agent, as it absorbs moisture rapidly from the air. Great heat is evolved when this acid is mixed with water, and care must be taken to bring the two together gradually, otherwise an explosive

combination may ensue. Many organic bodies, such as woody fiber and sugar, are completely decomposed and charred by strong sulphuric acid. See Acid.

Soda.— Sodium, a metal, silver-white, and soft at ordinary temperatures. When thrown upon water it floats, and rapidly decomposes the water with disengagement of hydrogen, soda being formed. The compounds of sodium are very widely diffused, being contained in every particle of dust, sea water containing nearly 3 per cent. of sodium chloride or common table salt. Sodium carbonate (see Carbonate of Soda) is made on a large scale from sea salt.

Sodium Chloride.— Common table salt. See Salt.

Sodium Bicarbonate.— Bicarbonate of Soda. Baking soda. Saleratus (Aerated salt). Obtained by exposing the crystallized carbonate of soda in an atmosphere of carbonic acid gas. Heating will convert it again to the carbonate form.

Spermaceti.—See Wax.

Steatite.—Soapstone, a variety of talc, which see.

Stearin.— A constituent of many animal and vegetable fats and oils. Tallow owes its firmness to the presence of stearin. Olein is the liquid or oily part, and stearin the solid part of oil or fat.

Silver White.— A pure variety of white lead, but more commonly known to painters as a filler material, a fine grade of pulverized silica.

Sulphate of Copper.— Blue vitriol. Bluestone, the common name, it being in large blue crystals. Made by dissolving copper oxide in sulphuric acid.

Talc.— A soft mineral of a soapy feel; usually whitish, greenish, or grayish color. Soapstone and French chalk are varieties of talc. Talcum powder is a toilet article composed of powdered talc and a perfume.

Tannin.— Chemically tannic acid.

Tannic Acid.— Tannin, gallotannic acid. Obtained

from gallnuts, which contain 50 per cent. or more; and from sumac, tea, etc. In brownish-white shining scales. Basis of writing ink and dyes. Strongly astringent.

Tartar.—*Salt of.*— Potass. carbonate, especially a pure form made by heating cream of tartar. *Cream of.* — Purified tartar. Chem., acid potass. tartrate, or potass. bitartrate. Tartar is the crystalline sediment of wine casks.

Terra Alba.— White earth. An old name for levigated gypsum. Gypsum ground in water and "floated," and dried. Plaster of Paris is calcined gypsum.

Tincture.— The finer and more soluble parts of a substance separated by a solvent.

Turmeric.— A vegetable dye, a yellow, and there may be used in its stead, answering the same purpose, Persian berries or quercitron bark.

Verdigris.— Copper Acetate. A dark green salt, poisonous. Obtained by action of acetic acid on copper. Formerly used in painting, but besides being poisonous it was liable to fade, blacken, and react with other substances.

Water Bath.— To prevent the overheating or burning of a substance that is to be boiled it is placed in a vessel, which is placed within a second vessel containing water, which, upon heating or boiling, heats the first vessel's contents sufficiently and without endangering it from overheating.

Water Glass.— Soluble glass. Silicate of soda. Silicate of potash. A substance consisting of silica which has been liquefied by extreme heat and pressure, in connection with potash or soda, potash giving *potassium silicate,* and soda *sodium silicate,* the latter being the more generally used by painters. It is a syrupy liquid, dissolvable in water.

Wax.— Bayberry, a fragrant green wax from the Bayberry or wax myrtle; called also myrtle wax. Bees-

wax, secreted by the bee, and used in the making of the honeycomb. A dull yellow solid wax, of agreeable odor, melts at 142 to 148 deg. F. Can be purified and bleached white, in which condition it is tasteless, odorless, and somewhat brittle. Insoluble in water, partially soluble in boiling alcohol, and miscible in all proportions with fats and oils (turpentine of course). Carnauba wax, obtained from the Brazil wax palm. It is yellow in color and brittle. Used in making candles. Ceresin wax is an amorphous substance, the insoluble part of cherry gum. Japan wax is obtained from the Japan wax tree, a Japanese sumac. Paraffin wax, see Paraffin. Spermaceti is a yellowish or white wax, solid, obtained from the oil of the sperm whale.

Whiting.— Calcium carbonate. There are various forms, as crude, commercial, gilders' bolted, English cliffstone, Paris white, Spanish white, all whitings made from chalk, but differing in grade or quality, according to amount of preparation in the making.

Woad.— A coloring matter from the woad plant, *Isatis tinctoria,* resembling indigo, consisting of the powdered and fermented leaves of the plant. Its essential constituent, indigotin, is identical with that of indigo, which has largely superseded it in dyeing.

Zinc Chloride.— Chloride of zinc. A white soluble deliquescent substance, formed by burning zinc in chlorine, or by dissolving zinc in hydrochloric acid.

Zinc Sulphate.— A soluble salt, crystallizing in long prisms, and commonly called white vitriol.

THE END